THE ILLUMINATING ENGINEER

THE JOURNAL OF

GOOD LIGHTING

LIGHT LAMPS FITTINGS AND ILLUMINATION

OIL GAS ELECTRICITY ACETYLENE PETROL-AIR GAS ETC.

Official Organ of the Illuminating Engineering Society

FOUNDED IN LONDON 1908

Edited by J. STEWART DOW

Vol. XXI February, 1928

Price NINEPENCE
Subscription 10/6 per annum, post free.
For Foreign Countries, 15/- per annum.

EDITORIAL AND PUBLISHING OFFICES:
32 VICTORIA STREET, LONDON, S.W. 1.
Tel. No.: Victoria 5215

Illuminating Engineering: The Past and the Future

ALLUSION was made in our last issue to the severe loss which this journal has sustained in the sudden death of its Founder and Editor, Mr. Leon Gaster, who was also the Founder and Hon. Secretary of the Illuminating Engineering Society. To the writer this comes home in a special sense, for he was associated with Mr. Gaster in the earliest beginnings of illuminating engineering in this country more than 20 years ago, and has watched its progress to the present stage under his sagacious guidance. This intimate relationship dates from the year 1907, when *The Illuminating Engineer* was about to be launched. But it is singular that even before then Mr. Gaster, with his characteristic alertness, had become interested in some of the writer's papers on photometry, and had taken note of his knowledge of the illuminating engineering movement then already originated in the United States. It was like him to have instantly recognized a common interest and similar ideals.

The President, in his introductory address at the last meeting of the Illuminating Engineering Society (see p. 51), has expressed the affection and respect which its members felt for their Hon. Secretary. He singled out as one of Mr. Gaster's dominant characteristics the personal charm which no one who knew him could resist, which gained him the esteem of authorities on lighting throughout the world, and was illustrated by the many generous tributes to his genius published in our last number. In the present number we are including a few more such messages which have since come to hand. It is sad to record that Mr. Gaster passed away without knowing of many of these messages, and before the issue of our special Twentieth Anniversary Number, to which he was looking forward with such pride and interest. In the midst of many tasks imposed by his sudden death we have been unable to reply personally to all these letters, and we should like to take the opportunity of thanking all those who have expressed their esteem for our late editor in such kindly terms.

Next to this indefinable quality of personal charm we would place the unusual width of outlook and foresight that he brought to bear on illuminating engineering. Naturally, no movement such as this can succeed without the aid of many helpers, who became continually more numerous as the years passed by. But it is no disparagement of their efforts to say that the creation of the movement was due mainly to Mr. Gaster's personal effort, and that its progress has been largely determined by his wise and far-sighted views. It was part of his genius to have recognized from the first that "illuminating engineering" was something different from other forms of engineering, and that the solution of its problems demanded the co-operation both of the expert and of the user of light.

A third quality which Mr. Gaster possessed to a remarkable degree was his power of sympathizing with and entering into the views of those of different nations. He had an intuitive genius for dealing with international affairs. It has often struck the writer that his gifts in this respect would have been valuable to this nation in a wider sphere. One of the very first steps he took when founding the Society and the Journal was to establish relations with experts on lighting abroad. For this purpose he made many journeys abroad, and he was always anxious that generous tribute should be paid in *The Illuminating Engineer* to the value of researches carried out in other countries.

Now his dominant personality has been removed. It is indeed a loss to the movement, and one which will be felt for many years to come. Yet it is some consolation to feel that the blow has come at a time when the movement is so firmly established that its future is assured. The Illuminating Engineering Society in this country will, we believe, continue on the same sound and broad lines which he designed. There is now general recognition that its possibilities of service are intimately bound up with its impartial standing and scientific outlook and the maintenance of its international relations. But in future the work will have to be more widely distributed. Each member should feel that the best tribute to Mr. Gaster's memory is to work for the enduring success of the Society which he served so devotedly.

The writer has been asked to take his place for the time being as Honorary Secretary of the Society, and also to act as Editor of this journal. The responsibility is a weighty one; but readers can rest assured that the policy of the journal will be unchanged and that no effort will be spared to make it even more serviceable than in the past. In particular, we shall make it our special care to foster relations with experts in other lands and to make *The Illuminating Engineer* what Mr. Gaster desired—a centre of information from all quarters and a medium for exchange of views between experts in all parts of the world.

The Effect of Different Systems of Lighting on the Output and Accuracy of Compositors

READERS will recall the striking report issued jointly by the Industrial Fatigue Research Board and the Illumination Research Committee last year, dealing with the relation between intensity of illumination and output of compositors. These experiments led to the important conclusion that full efficiency (judged both by output and freedom from errors) was only attained with an illumination of approximately 20 foot-candles.

A supplementary report now issued* deals with the more complex question of the effect of the system of lighting. Experiments were made with four systems—direct, semi-indirect, a combination of these two methods, and a fourth method utilizing indirect totally enclosed units. These units consisted of a white-enamelled opaque bowl surmounted by a trumpet-shaped pale-blue glass intended to give an approximate daylight effect free from the coldness of north light. In all these tests the illumination was maintained at 10 foot-candles.

As might perhaps be expected, the conclusions drawn from these experiments are less definite than those relating to intensity of illumination, one curious fact being that in this case increase in output did not always correspond with reduction of errors, as was the case in the former investigation. The investigation seemed to show, however, that pure local lighting was inferior to either direct general or semi-indirect lighting. The best output was obtained with direct units mounted 10 feet above the floor, but in this respect there was little to choose between the direct and semi-indirect systems. On the other hand, compositors were inclined to prefer the semi-indirect system because the glitter from new type was less noticeable and fatigue somewhat less evident. The third method—the combination of semi-indirect and local lighting—impressed the compositors very favourably; the output fell slightly, but the percentage of errors was also reduced.

The experience of the fourth system was particularly interesting. Compositors were unanimous in declaring this method the best they had tried, as regards restfulness and freedom from glare, though they formed the erroneous impression that the illumination was lower than in the preceding tests. Possibly, however, the real objection to the system was based on the comparative absence of shadow.

These tests ought probably to be regarded as suggestive rather than conclusive. Definite conclusions could probably only be expected after more prolonged experiments. There are a number of points that might be raised. One would like to know how closely the colour of the light furnished by the enclosed units resembled normal daylight. It is conceivable, especially during a short test, that the system regarded as most "restful" and conducive to accuracy might have a certain apparent restraining effect on output. A very "stimulating" system might lead to quicker but less careful work, and the stimulus might prove only temporary, output being ultimately reduced by fatigue.

All these points deserve consideration. Meantime the Committee have broken new ground in this complex investigation, and we shall look forward to further reports with great interest.

* "The Effect of Different Systems of Lighting on Output and Accuracy in Fine Work (Typesetting by Hand)": Joint Report of the Industrial Fatigue Research Board and the Illumination Research Committee. Published by His Majesty's Stationery Office, Adastral House, Kingsway, London. 4d. net.

Illumination and Public Safety

MUCH has been written regarding the influence of street lighting on accidents, and there is doubtless a good case to be made out for good illumination on this ground alone. But it should be recognized that this function of street lighting—to assist in the safe guidance of traffic—has only within recent years become the dominant one. The first and earliest function of public lighting was to ensure the safety of persons in the streets in a different way—i.e., as an aid to the police in preventing crime, robbery and disorder.

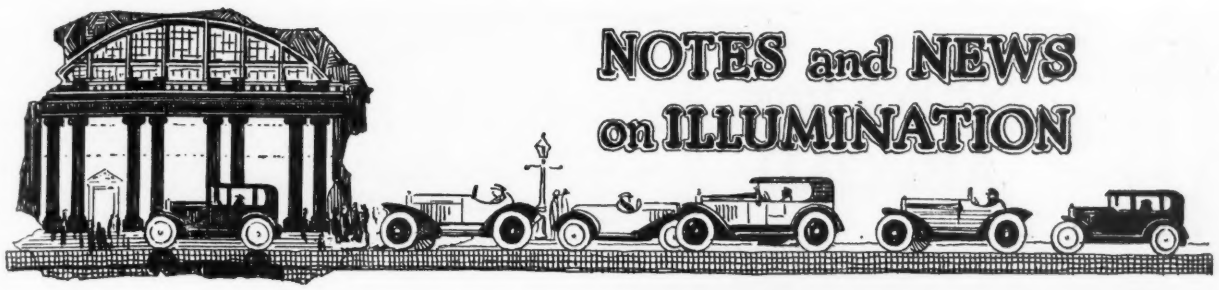
Attention was drawn to this aspect in a contribution to *Licht und Lampe* by Herr H. Lingenfelser, mentioned in our last issue.* The preparation of statistics relating to illumination and frequency of crime obviously needs care. Data comparing one section of a town with another and better-lighted one might be open to criticism on the ground that other conditions are also different. The same applies to comparisons between different towns and cities. Probably the most trustworthy means of investigation would be to ascertain the crime statistics for a section of a city, before and after the introduction of better lighting. This method is not often realizable in practice, and even in this case allowance may have to be made for "waves of crime" which vary from year to year. An ingenious effort to correlate these factors was, however, made in a paper read by Messrs. E. A. Anderson and O. F. Haas, read before the convention of the American Illuminating Engineering Society in 1921. The improvements in the lighting of Cleveland, conducted on a considerable scale, rendered a comparison feasible. It was shown that 90 per cent. of burglaries occurred during the hours of darkness, and that it was calculated that the better lighting was responsible for diminishing burglaries by 60 per cent.

One would naturally like to get confirmatory evidence from other quarters, and in cities where extensive improvements in public lighting have been undertaken the scrutiny of burglary statistics before and after the change might yield interesting results. It is obviously necessary to discriminate in the form of crime studied. One could not expect that better lighting would cause a diminution in all forms of misdemeanour. But there is good reason to believe that such offences as burglary and robbery are rendered more difficult by better lighting. Flood-lighting was used on a large scale in the United States during the war with the object of revealing the approach of unauthorized persons to important buildings. It is also said to have proved useful in checking thefts in railway yards, etc.

Meantime the statistics presented by Herr Lingenfelser for burglaries in Berlin are instructive. It appears that this form of crime follows much the same course as accidents do during the various months of the year, being approximately 50 per cent. more numerous in summer than in winter. This alone suggests that a direct relation between crime and lighting conditions will be found to exist.

The relation is not unlike that existing between accidents in factories and the time of year. As in that case more detailed researches would no doubt confirm the belief that the trouble is most acute where illumination is least, i.e., that so far as burglary is concerned the "crime-rate" is greatest during the hours of darkness.

* *The Illuminating Engineer*, January, 1928, p. 4.



Forthcoming Meetings

Amongst the items for the present month attention may be drawn to the next meeting of the Illuminating Engineering Society, which will be held at the E.L.M.A. Lighting Service Bureau (15, Savoy Street, Strand, W.C.), on February 28th. Members will have an opportunity of examining the latest arrangements for demonstrations, and of hearing from Mr. Bush something of its activities. Another meeting of considerable interest is that arranged by the Institution of Public Lighting Engineers, also at the E.L.M.A. Lighting Service Bureau, on February 21st, when a discussion on "Road Traffic Signs" is to be opened by Mr. W. J. Jones. We have previously called attention to this meeting, at which members of the Illuminating Engineering Society will be welcome. The use of luminous devices as an aid to traffic control constitutes a new branch of illuminating engineering, and offers special opportunities for the exercise of skill and ingenuity. A third interesting item for the month of February is the paper on "Theatre Lighting" to be read by Mr. Henry G. D. Wilkinson, at the Royal Society of Arts, on February 8th. This event takes place as we are going to press, but we hope to make some reference thereto in our next issue.

The Illumination of Officers on Point Duty

The two illustrations in our December issue (p. 355) contrasting two methods of lighting the figure of a police-officer on point duty have led to some comment. It will be recalled that this comparison was intended to show that light coming from immediately above is apt to be somewhat ineffective, because the illumination received by the vertical surface of the officer's body is naturally low. It has been pointed out, however, that the case illustrated was a rather extreme one. In general, the results of light directed downward would be better than the photograph suggested, especially if the officer is provided with a white coat instead of one with dark material. In these circumstances, it is suggested, lighting from above may prove quite useful, especially if, as is usually the case in practice, this illumination is supplemented by light coming from other directions, e.g., from neighbouring public lamps. We agree; but we still think that it is usually inexpedient to rely *alone* on illumination from a lamp immediately overhead.

Susceptibility to Glare

The problem of devising general rules for the avoidance of glare is complicated by the personal equation. Some people are more sensitive to bright light than others, and much depends on the state of health and the condition of the eyes. A correspondent shows us a cutting from the daily press in which a somewhat novel point is raised—the colour of the observer's eyes. The inference is made that exposure to glare is particularly trying to persons with grey or blue eyes. At first sight it may seem strange that the colour of the muscle controlling the pupil aperture can have any effect, but it may be argued that there is less protection against the heat and infra-red rays, which may therefore have a tiring effect. It is well known that dwellers in the tropics rarely have light grey, blue or green eyes; brown, and even black, is the predominant colour. This fact has been adduced as evidence of adaptive protection against the effect of fierce sunlight.

Mr. John Stewart Dow, who is now becoming Editor of this journal, was born in 1881. After passing through the course in electrical engineering at the City and Guilds of London Engineering College, he was for some years on the staff of the College, and was later engaged in research work, chiefly on photometric problems. He became associated with the late Mr. Leon Gaster in 1907, shortly before *The Illuminating Engineer* was started, and has ever since acted as the Assistant Editor of the journal. He has also acted as Hon. Assistant Secretary of the Illuminating Engineering Society since its inception in 1909.

The Lighting of the House of Commons

The lighting of the House of Commons, by means of electric lamps concealed above the diffusing-glass roof, is always a source of interest to visitors. It is not so very many years since metal-filament lamps were substituted for carbon ones, and, in view of the conservative attitude of members to changes, the alteration had to be carried out with considerable circumspection! It is not, perhaps, usually known that a signal for the switching on of the lights can be given by means of a switch-button concealed in the arm of the Speaker's chair. Occasionally the effect may be dramatic, as, on one occasion, when Mr. Ramsay Macdonald's plea for more information, "I am speaking in the dark," was followed by the turning on of the artificial light.

A Standards Year Book

An enterprising step has been taken by the Bureau of Standards in the publication of the Standards Year-book (1927). This is intended to convey a general view of the ramification of the movement towards standardization, which has developed so rapidly throughout the world during the last 25 years. This Standards Year-book is being issued as a Bureau of Standards Miscellaneous Publication (No. 77), and copies ($1 each) may be obtained on application to the Superintendent of Documents, Government Printing Office, Washington.

Lighting in Connection with Navigation

Two of the series of papers read at the recent annual meeting of the German Illuminating Engineering Society at Hamburg have now appeared in *Licht und Lampe*. Dr. Burath deals very fully with visibility and the design of ships' lanterns, and Herr O. Wundrum has an illustrated contribution dealing with dock lighting. Under this heading, as may be imagined, many different lighting problems present themselves; apart from the lighting of quays, there are illustrations of methods used on the canals, one striking illustration showing a water-way of this description lined by buildings on either side and illuminated by central suspended lanterns in the same manner as a main street. Another installation is that in the tunnels under the Elbe, each 425 metres long. The illumination is effected by 25-watt lamps mounted direct on the wall of the tunnel, yielding an average illumination of about 8 lux (approximately 0.75 foot-candle).

A Lighting Journal in Belgium

We have received a copy of a useful little journal edited by Monsieur Charles Huaux, in Brussels, which is entitled *L'Eclairage*, and deals generally with the importance of good illumination. One of the chief articles is devoted to industrial lighting, and the drawbacks of unsatisfactory lighting conditions in factories are strongly emphasized. A summary of the essentials of good lighting follows. We notice that the suggested minimum values of illumination, expressed in lux, are not far removed from those generally approved in this country. There are also articles dealing with fundamental points, such as the definition of luminous flux. We welcome this departure as an illustration of progress in illuminating engineering in Belgium, and look forward to receiving further copies.

The Use of X-Rays to Detect Flaws in Cable Splices

According to *The Electrical World*, a new use has recently been found for X-rays in the examination of cable splices, flaws in which are notoriously difficult to detect once the job is completed. The Puget Sound Power and Light Company has now been using this method for more than a year to investigate defects in leadless submarine cables—such as decentralization of the conductor, gas pockets, or lack of homogeneity of the rubber, etc. The original article contains three illustrations, one showing a perfect splice, the other two imperfect splices and lack of adhesion of rubber. To the unpractised observer the indications given by such photographs do not always seem very clear; but to the experienced operator they often convey a great deal of useful information. The Puget Sound Company has had no failures of splices which have passed the inspection of the critical X-ray eye.

The Cost of Light—Now and 50 Years Ago

It is a remarkable fact, not always sufficiently realized, that whereas the cost of most commodities is to-day very much greater than it was fifty years ago, *light* is to-day very much cheaper than it has ever been This point was emphasized neatly in a recent note in the *Electrical World*: "If the unskilled labourer of a half century ago had used as much light as is now used daily in the average home in this country, he would have had to work two and a half hours daily in order to pay his gas-lighting bill alone, as compared with approximately ten minutes daily for the average unskilled labourer to pay his present electric lighting bill." This great difference is due to the diminished cost of light, and is not a matter of comparison between the two illuminants. Gas lighting to-day, like electric light, is far cheaper than the illuminants of days gone by. But the comparison becomes even more striking when lighting by candles in the past is considered. "At the present time the average family is spending seven cents a day for electric light in the home. On the same basis of comparison, if the labourer of a half-century ago had used tallow candles to supply as much light in the home as he uses now, he would have been able to purchase nothing but light, and he would have had to labour almost 24 hours a day to pay for that!"

The same point is made by a recent contributor to *Licht und Lampe*, who presents the following figures:

AMOUNT OF LIGHT RECEIVED BY THE EXPENDITURE OF ONE GOLD MARK.

Year.	Illuminant.	Candle-hours.
1875	Oil lamps	150
1885	Gas lighting	600
1895	Electric (carbon filament)	500
1865	Candles	100
1905	,, (tungsten filament)	1650
1915	,, (gasfilled lamp)	2200
1925	,, ,,	3500

The table serves as a useful record of the continual cheapening of light, though it would be more comprehensive if modern forms of gas lighting were included. But it is pointed out that, light for light, the old tallow candle was roughly 35 times as dear as electric light to-day.

Trade Marks in the Lighting Industry

A contributor to *Licht und Lampe* describes, with illustrations, a curious collection of trade marks that have been used in the lighting industry from early days. Some of the designs go back to quite an early date, the trade mark of Ehrich and Grätz, for instance, dating from 1865. Naturally the earlier devices frequently embody traditional forms of oil lamps. The adoption of a circular form in many cases is traced to the cylindrical wick used in petroleum lamps. From 1890 onwards the introduction of incandescent gas mantles is reflected in trade-mark design; curiously, in the early days of electricity the trade marks adopted seem to have been few in number. During more recent years the preference for word-devices, such as the familiar anagrams adopted by many leading German firms, has become marked. Even in 1915 a list of about 200 such word-signs and trade names was published in *Licht und Lampe*. To-day there are no doubt many more.

TECHNICAL SECTION

COMPRISING

Transactions of The Illuminating Engineering Society and Special Articles

The Illuminating Engineering Society is not, as a body, responsible for the opinions expressed by individual authors or speakers.

Problems in Illuminating Engineering

(Proceedings at the Meeting of the Illuminating Engineering Society, held at the House of the Royal Society of Arts (18, John Street, Adelphi, London, W.C.), at 6-30 p.m., on Tuesday, January 24th.)

A MEETING of the Illuminating Engineering Society was held at the House of the Royal Society of Arts (18, John Street, Adelphi, London, W.C.), at 6-30 p.m. on Tuesday, January 24th, the PRESIDENT (Dr. D. R. Wilson) presiding.

TRIBUTE TO THE LATE MR. LEON GASTER, FOUNDER AND HON. SECRETARY OF THE ILLUMINATING ENGINEERING SOCIETY.

Before proceeding to actual business, the President gave a short address, alluding to the great services rendered to the Society by its Founder, Vice-President and Hon. Secretary, Mr. Leon Gaster, who passed away on January 7th, after a short illness.

Their first duty was to move a resolution relating to this sad event.

The PRESIDENT continued: —

"I do not think I need preface this resolution with many words. Most of you know as well as I do—many of you perhaps better than I—how much our Society has always owed to him, and how from the very start he devoted the greater part of his ability and energy to its interests.

To have kept such a Society not only alive but active for nearly 20 years, including the difficult period of the War, is no small achievement, and shows, what I have always felt, that in spite of his numerous other activities the development of illuminating engineering was Mr. Gaster's favourite subject, and that the success of our Society was always the topic foremost in his mind.

It would be out of place here to attempt any analysis of Mr. Gaster's character, but I cannot forbear from recalling two qualities that have always specially appealed to me—his invariable readiness to help others at whatever cost in time and trouble to himself, and that indefinable characteristic, personal charm, which created in me, and I think in all of us here who knew him at all intimately, a genuine feeling of affection. On the other hand, his failings—and in common with us all he possessed some—seem to me to have been venial ones and the outcome of his vitality and definiteness of purpose.

I suggest to all here that the best tribute to his memory will be the continuance and prosperity of the Society for the object for which it was founded. There are many matters that will call for careful consideration, but I feel sure that, by the help of all of you who have shown yourselves interested in its welfare, any difficulties can be overcome and the Society continued on a thoroughly sound footing. In this connection we shall all agree that we are fortunate in having had Mr. Dow in charge of the Society's affairs since Mr. Gaster's death, and we are already indebted to him for the immense amount of time and trouble he has taken in preparing the information to be put before you this evening."

The following resolution was then moved by the President and was carried unanimously, all present standing in respect to Mr. Gaster's memory: —

> *"That the Members of the Illuminating Engineering Society hereby record with deep regret the loss sustained by them in the death of Mr. Leon Gaster, the Founder and Hon. Secretary and Vice-President of the Society.*
>
> *They recall with grateful appreciation the invaluable services rendered by Mr. Gaster, not only to their Society by his able and disinterested conduct of their affairs as Hon. Secretary during nearly Twenty Years, but also to the cause of Illuminating Engineering throughout the World."*

The PRESIDENT then announced that the Council had invited Mr. J. S. Dow to become Hon. Secretary for the time being, and he would ask Mr. Dow to say a few words.

Mr. J. S. DOW expressed his appreciation of this mark of confidence on the part of the Council, and assured those present that he would do his utmost on behalf of the Society. Mr. Gaster's illness had been but a brief one—he was only ill a week. He (Mr. Dow) had been with him on the day of his death. Although unable to speak much, Mr. Gaster's mind even then was occupied with the work of the Society and its journal. It was a tragic circumstance that Mr. Gaster had passed away on the eve of the publication of the special Twentieth Anniversary issue of the journal, to which he had looked forward with such pride and pleasure. (Mr. Dow added that although the issue of this journal had been inevitably delayed by Mr. Gaster's death, he had placed on the table a few advance copies, which some of those present might like to see.)

Mr. Dow recalled that he had been associated with Mr. Gaster for more than 20 years, and had shared in the preparatory work leading to the starting of *The Illuminating Engineer* in 1908, and the founding of the Society a year later. They had both been present at every general meeting of the Society, every Council meeting, and every meeting of committees formed by the Society in which they were both concerned. It was inexpressibly sad to him to realize that this was the first occasion on which they had been separated. He felt that it was unnecessary to add to what the President had said regarding Mr. Gaster's inestimable services to illuminating engineering, and he was confident that all members of the Society would share the desire of the President and Council and himself that its work should continue and that the Society should realize the ideals of its Founder.

The PRESIDENT then announced that owing to the death of Mr. Gaster the Council had decided that the annual dinner ought to be cancelled this year and held instead in 1929, when the Society would be celebrating its Twentieth Anniversary.

After the minutes of last meeting had been taken as read, the PRESIDENT then asked the Hon. Secretary to present the names of applicants for membership, which were as follows:—

Ordinary Members—

Adams, S. .....Investigator to the Industrial Fatigue Research Board, 7, Florence Street, Manchester.

Iliffe, A. E. .....Electrical Engineer, Benjamin Electric Ltd., Brantwood Works, Tariff Road, Northumberland Park, Tottenham, London, N.17.

Jolley, L. B. W. .....Research Engineer, Research Laboratories of the General Electric Co. Ltd., Wembley, London, N.W.

Nunn, C. .....Chief Electrical Engineer, *The News of the World*, 30, Bouverie Street.

Poh, S. S. .....Manager and Electrician, National Electric Co., 427, Telek Blaugah Road, Singapore.

Sustaining Members—

Messrs. Willis & Bates, Ltd., Polton Works, Halifax. (Representative: Mr. A. Bates.)

Messrs. Revo Electric Ltd., Britannia Works, Tividale, Tipton. (Representative: Mr. E. F. Middleton.)

The names of applicants for membership presented at the previous meeting* were also read again, and these gentlemen were formally declared members of the Society.

The PRESIDENT then explained that this meeting was to be devoted to a series of short contributions dealing with various problems in illuminating engineering. He would also ask Mr. S. G. Elliott, of the Underground Railways, to open the discussion with some notes on "Escalator Lighting."

Subsequent contributions were made by Mr. A. CUNNINGTON on "Problems in Foundry Lighting," Mr. H. C. WESTON on "The Use of Special Glasses for Very Close Work," Mr. C. E. GREENSLADE on "Problems in Daylight Illumination," and Mr. J. S. DOW on "Subway and Tunnel Lighting."

The Lighting of Escalators on the London Underground Railways

By S. G. ELLIOTT

Escalators or moving stairways are installed on the Underground Railways in tunnels of varying diameters, as follows:—

1. Single escalators in tunnels 12 feet diameter.
2. Double escalators in tunnels 17 feet diameter.
3. Double escalators with one fixed stairway in tunnels 19 feet diameter.
4. Triple escalators in tunnels 22 ft. 6 ins. diameter.

The vertical height from the step to the crown of the tunnel is 9 feet, 10 ft. 6 ins., 12 ft. 6 ins., and 13 ft. 6 ins. respectively. An exception to the above is the triple escalator tunnel at Tottenham Court Road, which is 26 feet diameter, with a height from step to crown of tunnel of 16 feet. The angle of inclination of the tunnels is practically the same in all cases, namely 30° from the horizontal, and the escalators are of various lengths, the present minimum being 34 feet and the maximum 128 feet.

It has always been the continuous policy of the Underground Railway Company to shield lamp filaments from the eyes of passengers, and this is particularly necessary on stairways. It is also considered necessary that the tunnel roofs should be sufficiently well lighted. Hence, in dealing with the lighting of the first escalator, installed in the year 1911, a satisfactory installation was made by installing the lamps close up to the tunnel roof and interposing a metal screen on the up side to shield direct light from the eyes of persons descending and a horizontal glass screen below the lamps to act as a diffuser, and also shield direct light from the eyes of persons ascending. In practice, however, it was found that the glasses required a good deal of cleaning, owing to the amount of dust carried up the escalator tunnel, and, further, that more light on the roof was desirable. Consequently in all future installations the horizontal glass was eliminated, and the screen was retained but ramped on the up side back to the tunnel

FIG. 1.—The Lighting of Escalators: Direct System at Maida Vale.

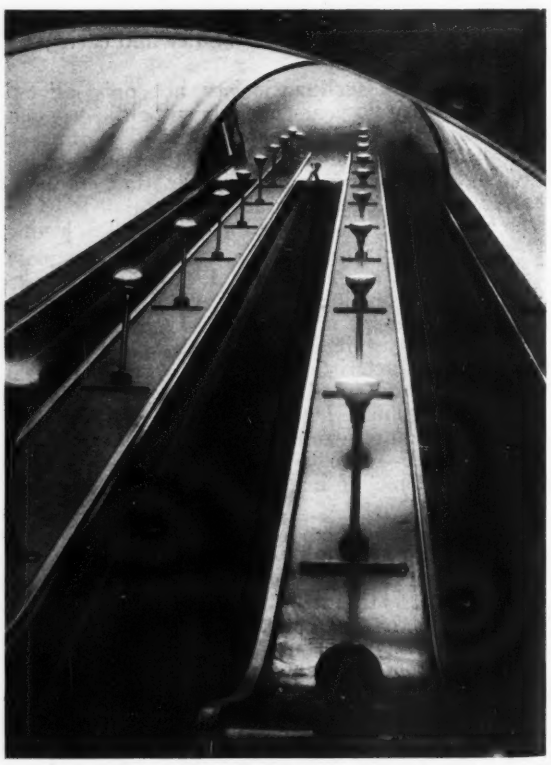


FIG. 2.—The Lighting of Escalators: Indirect System, Waterloo Station.

* *The Illuminating Engineer*, January, 1928, p. 5.

the roof. Only fully obscured lamps were employed, this being sufficient to prevent glare. In the large-diameter tunnels the size of the screen necessary to meet requirements was of considerable proportions, namely 2 ft. 6 ins. deep, and the length of the ramp 5 ft. 6 ins. at the crown of the tunnel.

It is interesting to recall that when the C.L.R. Tube Railway was extended to Liverpool Street in 1912 single stairway escalators were built at Liverpool Street, and the lighting was carried out by means of the "Moore Light" tube—the tube was 2 inches diameter and luminous throughout the length of the escalator tunnels and in the lower circulating chamber; it was fixed close up to the roof of the tunnel, and the luminous length was approximately 274 feet, arranged in three lengths star-connected on a three-phase supply at a pressure of 17,500 volts. The candle-power of the tube was not measured, but it was claimed by the makers that, efficiently worked, the tube should give 55 candle-power per yard. The use of this form of lighting was discontinued in 1914.

The whole question of an improvement in the fitments of escalator tunnels was reviewed early in 1927, and as the outcome of experiments an indirect lighting system was installed at Waterloo, where new escalators were brought into service in September, 1927.

This indirect system for a triple escalator tunnel consists of 100-watt internally frosted lamps, contained in mirror-glass reflectors, mounted in bronze housing on plain bronze-tube standards. The height of the fitting above the steps being 6 feet, is such that the light source is not visible to persons either ascending or descending, but the use of domed glass covers provides a touch of light, and so avoids that sensation of "something missing" noticed by most people in places lighted by indirect methods. The standards are arranged in a double row at 12 feet intervals, and the illumination of the roof is sufficiently uneven to avoid a sense of monotony which might otherwise be noticeable.

The current consumption for the indirect system is about 80 per cent. more than for the direct system, and the illumination on the stair treads in both cases 2 foot-candles. Maintenance of the system is simplified as lamp renewals and cleaning can be readily attended to during traffic hours without the use of the long ladders necessary when the lamps are fixed close to the roof, but cleaning work has to be undertaken at more frequent intervals than with the direct system, the domed-glass covers being dusted each day by the station staff, and the interiors cleaned at intervals of two weeks by the electrical staff.

Problems in Foundry Lighting

By A. CUNNINGTON (Southern Railways Ltd.)

Mr. CUNNINGTON said: I was recently asked to improve the lighting of an iron foundry used exclusively for dealing with comparatively small castings, viz., rail chairs.

It was pointed out to me first of all that light coming from the side of the moulds would be better than light from above, on account of the necessity to see the condition of the inner hollows after removing the pattern. Accordingly angle reflectors were fixed at intervals along the wall, producing cross-beams of light in which the inner portions of the mould were fairly well shown up.

Great difficulty was, however, experienced in keeping the fittings clean owing to the amount of dust and dark sand always floating about. These conditions, in fact, seem to indicate that the maintenance of lighting at a low level would make it prohibitive as a practical measure, although from the illumination point of view the method was fairly satisfactory.

A later test was made with a floodlight erected high up on the end wall of the foundry, and this was found to give a very useful illumination over a considerable area, but the side shadows cast by it were somewhat of a handicap.

The final arrangement now being adopted is a system of floodlights fixed in the highest part of the roof, and arranged to cover an area of about 100 square yards for each floodlight. A considerable advantage of the latter method is that the fittings are well out of the way and the reflector, being in a downward direction, catches the minimum of dust. A simple raising and lowering device enables the cleaning to be carried out readily.

It is interesting to note that the order of illumination required in the foundry was very much more than the average owing to the excessively poor reflecting factor given by the dark grey sand of the floor and the moulds.

The Use of Special Glasses for Very Close Work

By H. C. WESTON

(Investigator to the Industrial Fatigue Research Board)

The illumination of very fine work is often of a high order because local lighting is usually employed, sometimes with adjustable fittings which allow the lamp to be brought within a few inches of the work. In spite of this, those who are brought into contact with people who do work of this description know that there are many who still find it trying, and who attribute their difficulty to inadequate or unsuitable lighting. This is often unfair, because the perception of detail depends upon other factors besides illumination.

Obviously, if the details of the work are so small that only a minute image of them can be formed on the retina, magnification of the image rather than of the illumination of the object is required.

There are, however, a number of processes involving work which is not too fine to be seen by the unaided eye, provided this is fully, or almost fully, accommodated, and it is in these cases that the provision of ample illumination is likely to be disappointing if it is expected to remove all cause for complaint on the part of the worker. If the character of the work is such that excellent visual capacity is required, any slight defect which reduces visual acuity—any loss of the power of accommodation, which is inevitable as the age of the worker increases—will make it more difficult to carry on the work comfortably, and since these two defects may be so slight as to cause no inconvenience outside the factory, they are often unsuspected and the lighting is blamed for discomfort experienced during working hours.

Even the worker who has normal visual acuity and amplitude of accommodation cannot be expected to work for long periods without discomfort if his work requires the eyes to be brought so close to it that extreme accommodation is used.

The use of the full power of any group of muscles for long periods is impossible without great fatigue, and for this reason many mechanical devices are used in industry to reduce the effort required by a worker to a degree which is physiologically economical. Illumination is a means for reducing visual effort, but in some cases it is incapable, by itself, of doing all that is required in this respect, and the use of prismatic glasses designed to reduce accommodation and convergence is a supplementary measure the adoption of which has led to most encouraging results in experiments which have been made for the Industrial Fatigue Research Board.

These glasses are worn as ordinary spectacles, and are prescribed for each individual so as to include corrections for any errors of refraction. The strength of the glasses depends upon the amount of accommodation which the workers find it necessary to use, and on the range of clear vision which the work demands. The glasses are then arranged to reduce the amount of accommodation and convergence the worker will have to exercise to rather less than that which would be used for reading at about 10 inches, which is generally considered a comfortable distance.

These glasses have been supplied to workers doing such diverse operations as linking hosiery, sorting and mounting miniature lamp filaments, drawing-in warps in the cotton industry, examining needles and filing small fish-hooks. In all cases, with the exception of the needle examiners, for which records are not yet available, not only have all complaints of headaches and other symptoms of eyestrain disappeared since the

adoption of the glasses, but considerable increases of output have been obtained, amounting in some cases to over 30 per cent., the average being over 10 per cent. In most cases excellent natural and artificial illumination was available, and it is very doubtful whether anything would have been gained by still better provision for lighting. In all these cases the work has been done for years with the unaided eye, and is still done in some factories under less favourable conditions of lighting, but no doubt with a loss of efficiency, the extent of which can be judged from the figures quoted.

The illuminating engineer confronted with the problem of providing for the illumination of very close work will, I think, better satisfy all whom his installation will affect if he recognizes when conditions are such that a lavish provision of light cannot wholly achieve its object, which, in the factory, is to enable work to be done with the greatest efficiency and comfort. I would suggest that whenever continuous work is done with the eyes not more than seven or eight inches from it, even when there is a reasonable amount of local light —say 25 or 30 foot-candles—the use of glasses should be considered in preference to any further increase of illumination.

Two Daylight Problems

By C. E. GREENSLADE

The first problem is the simpler of the two; it consisted of redistributing daylight in a room to make it light the fireplace and the far corners.

The room was at the back of the house, having a bay window overlooking a yard between two houses of the same row. The slant portion of the window had a free outlook to the sky; the larger window had a blank brick wall as outlook, while the other slant portion of the window faced towards the house. This latter would be of little value for lighting in any case. As might be expected, the floor close to the window was well lighted, but the rest of the room was dark.

The use of outside daylight reflectors was impossible, as the yard served as a passage-way from a pair of french windows, and there was little clearance at best. The outer portion of the window with the freest outlook was left plain to light the table in the room and to avoid a bottled-up effect which takes place if all windows are obscured.

The upper part of the centre window, which had an outlook on to the brick wall, was fitted with prismatic window glass, on one side the 45° variety, which turns light received at 45° to the horizontal outside into the horizontal inside, and alongside it a sheet of the 60° variety. The first served to light the far corners of the room, while the second amply lighted the fireplace. The glass is rather heavier than ordinary window glass, so a pair of heavier sash-weights was required.

As well as making the room more comfortable, it was possible to do without artificial light till a later hour in the evening, lighting-up time having been very early in this room.

The second problem was, at first sight, a very puzzling one, and only indirectly connected with lighting. A room was described as "uncomfortable," but at night-time the objection disappeared completely. In this case there was no lack of light, as the window was large, the outlook over a small yard, and then unobstructed for miles.

The room was of a pale rose-pink colour, with a reflection coefficient of 40 per cent, and well lighted except just where the wall adjoined the window.

At night the room was lighted with a central gas pendant equipped with a Holophane focussing reflector, the metal support to which had been reduced to the minimum size safe. A test with a lumeter showed an intensity of 10 foot-candles on the table underneath the light, and surface brightnesses of the walls at 4 ft. 6 ins. from the floor of 0.17 foot-candle, while on the ceiling 2 feet from the lamp 0.5 foot-candle was registered. Alterations to the lighting designed to make the room as uncomfortable as in the daytime were attempted. These seemed to show that for comfort the ceiling should have twice the surface brightness of the walls at least. Of course, this was difficult to obtain by daylight, and, in any case, did not appear at first to be the solution. Upon consideration, a simple test seemed worth trying, so the roof of a low shed in the yard was painted white, only the half-corrugation of the iron looking towards the room being treated.

This reflected a good light on to the ceiling, and proved the solution of the trouble, no further complaint being raised against the room as uncomfortable. A pot of paint thus served to solve this lighting problem.

The Lighting of Tunnels and Subways

By J. S. DOW

The lighting of tunnels and subways includes a number of somewhat different problems. We have, for example, the comparatively short subways, such as traverse the London streets, and the longer ones utilized by the Underground Railways. We have also in London the section of tunnel where the trams passing from Westminster to Holborn dive underground. Lastly we have the much more lengthy Rotherhithe and Blackwall tunnels which pass under the Thames.

The lighting installations in many of these subways were originated many years ago, and present few striking features. In some cases they are capable of considerable improvement, exposed filaments and mantles being frequent. In the longer tunnels redesign of the lighting would be expensive, but faults in regard to glare on street subways should be remedied fairly easily; in such cases the presence of glaring lights in the range of vision is particularly objectionable, as persons come out of the subway in a more or less dazzled condition, which is not favourable to safety in traffic.

In many of the subways on the Underground Railways much better methods of lighting are adopted, a feature being the use of screened sources or lamps recessed in the roof, so that they are out of view. Some time ago reference was made to the lighting of a recently executed subway at Charing Cross tube station as a good example of what can now be done.

In the issue of *The Illuminating Engineer* about to be published* there is a note on one remarkable installation—in the newly opened Holland Tunnel connecting Manhattan Island and New Jersey in the United States. The design was very systematically worked out by the aid of a miniature model of the tunnel, and was preceded by a study of methods in some of the chief tunnels and subways in Europe. The chief feature of the system ultimately adopted is that lamps are recessed behind diffusing glass in the walls of the tunnel, so that there is a clear view down its entire length. The illumination is stated to be very uniform, the maximum being 1.4 foot-candles and the minimum 1.0, which is an unusually high value for installations of this kind.

Discussion

Mr. A. BLOK said that he would like to know the dimensions of the foundry mentioned by Mr. Cunnington, and also the approximate consumption in the two cases. The tunnel which Mr. Dow had described was under very careful supervision; according to the accounts he had seen, it was almost impossible for any mishap to occur in it; for example, there were police on constant duty in the tunnel, and if a car broke down it was immediately removed by a motor-truck which was run in specially for the purpose. Mr. Greenslade's second problem had been, he thought, dealt with in a very interesting fashion. He would like to know if the glass used would answer its purpose if the ribs were vertical, or at any rate not horizontal.

Mr. C. E. GREENSLADE said that there was no reason why the glass should not operate equally well vertically or laterally.

Mr. A. BLOK, continuing, remarked that in the case of prismatic and grooved glass systematic cleaning was very important. Otherwise, owing to the deposits of dirt, any advantage accruing from its use quickly dis-

* *The Illuminating Engineer*, January, 1928, p. 4.

appeared. Horizontal grooves were most likely to collect dust. He would not say that this was an insuperable difficulty, but there was no doubt that regular cleaning was essential; otherwise people who were enthusiastic at first were apt to wonder after a few weeks whether the installation was worth while.

Mr. W. J. JONES congratulated Mr. Elliott on the ingenuity shown in tackling various lighting problems on the Underground Railways, and especially on the indirect installation at Waterloo. He (Mr. Jones) had recently taken a friend from the United States to see it, and his comment was: "Gee! it's a fine job." He hoped Mr. Cunnington would furnish some further information about the foundry lighting. He was anxious to collect data regarding instances in which floodlighting had apparently been applied with useful results. He was much interested in the experiments described by Mr. Weston. They illustrated the importance of a knowledge of the mechanism of vision in dealing with lighting problems. Mr. Dow had raised some useful points in connection with the lighting of tunnels and subways. Another case that might be mentioned, and which deserved study, was the lighting of tunnels caused by the passage of railway bridges over roads. Mr. Jones concluded by expressing the opinion that such meetings as this, which afforded an opportunity for raising problems in illuminating engineering, were of great educational value.

Mr. C. E. GREENSLADE said that he was inclined to think that an illumination of 2 foot-candles by indirect light was somewhat better than 4 foot-candles by direct light. Experiments made in the laboratory tended to support this impression. There was just one little point in connection with the escalator lighting he would like to raise—the apparent streakiness of the illumination on the ceiling. He would like to know whether the lack of uniformity was deliberate, because he believed that, in general, uneven lighting of the ceiling was considered a drawback in indirect lighting installations. Mr. Greenslade also enquired whether the dome fitting was ventilated in any way. He thought that it might require rather frequent cleaning; possibly it might be entirely enclosed, and thus rendered substantially dustproof, suitable provision for cooling being made.

Mr. S. G. ELLIOTT explained that they had not aimed at securing uniform illumination of the ceiling throughout its entire length. His impression was that, as the ceiling came prominently in view of persons descending the escalator, the effect would be somewhat monotonous if the illumination was perfectly even. He could not go so far as to say that 2 foot-candles obtained by indirect light were equivalent to 4 foot-candles by direct light. He had been carrying out some experiments on the lighting of a station now under construction, in which both direct and indirect lighting had been installed. The average illumination in the two cases was substantially the same, and whilst he thought that in this case the effect of the direct lighting was the more agreeable he believed that, in general, one did not see quite so well when the light source was visible.

He agreed that the entrance of dust into lighting fittings was apt to prove a great difficulty, and he had not seen any fitting which was adequately ventilated and which was not more or less subject to the entrance of dirt—a film on which diminished the working illumination considerably.

Capt. E. J. HALSTEAD HANBY, referring to Mr. Weston's investigation, remarked that the question of the intensity of illumination requisite for clear and sustained vision was intimately associated with the quality of the light. This point would naturally also have a direct bearing on visual acuity. Recent investigations had led to the assumption that for some forms of fine work illumination up to 20 or 30 foot-candles was necessary. He suggested that it was necessary to conduct experiments over a considerable period before deciding on this point. He believed it would be found that over a long period the first immediate gain in efficiency arising from high illuminations with ordinary electric light would not be sustained, and that ultimately it would be found that the result was no better than that obtained with, say, 4 foot-candles. The question of the relative effect of natural and artificial daylight, in comparison with uncorrected electric light, needed investigation. He hoped that the experiments Mr. Weston had already made would be extended so as to include a really systematic comparison of results by daylight and artificial light. He anticipated that the results would show clearly the superiority of natural light, to which the human eye was best adapted.

In the course of subsequent discussion the question was raised whether long-continued experience of artificial lighting might not accentuate, or even create, organic defects in vision. This was suggested by experience in the Colonies, where it had been found that the eyesight of those accustomed to an outdoor life and possessed of naturally keen vision deteriorated when they became engaged in office work.

Mr. H. C. WESTON said that the results of his investigation hardly applied to this problem. All that they implied was that there were many people who had slight defects of vision and experienced no trouble until they were asked to do some form of very close work, possibly under bad conditions of lighting. They were then apt to suffer from headaches and other symptoms of eyestrain. He could not affirm that inadequate lighting was never responsible for visual defects, though, so far as he knew, it did not cause errors of refraction. But it was a common experience that specially exacting fine work did reveal defects of vision of which the person concerned might have been otherwise unaware.

In regard to the limits of visual acuity by natural and artificial light, it was very difficult to make an exact comparison. The limiting illumination desirable naturally depended on the nature of the process. He recalled a book by Sir John Herbert Parsons in which the author spoke of the limit of visual acuity, for ordinary processes, being attained with an illumination of about 3 foot-candles.

Mr. A. BLOK said that the relation of intensity and quality of illumination to acuteness of vision was a fascinating problem. The conditions desirable for close vision were not necessarily the same as those for more distant work. He recalled some experiments he had made during the war on the lighting of rifle ranges. He believed that the illumination was carried as high as 150 foot-candles. The performances of marksmen under different conditions of artificial lighting were carefully noted, and the experiments led to several interesting conclusions. Apparently marksmen were unconscious of any sensation of glare within the range of illumination utilized; yet it was found that after a certain illumination had been attained, he believed about 30 to 40 foot-candles, no material advantage was gained.

Mr. C. E. GREENSLADE expressed his interest in the results recorded by the last speaker. He himself had been recently concerned with a somewhat similar problem, the lighting of blackboards. In this case the reflecting power of the surface illuminated was low, probably of the order of 6 to 10 per cent.. Thus an illumination of 30 foot-candles would only produce a brightness equivalent to 0.18 to 0.3 foot-candle on a perfectly white surface. Nevertheless, the general conclusion was that when the surface brightness exceeded about 0.15 foot-candle the effect became distinctly uncomfortable.

Mr. H. C. WESTON pointed out that the last two problems illustrated the importance of other factors besides illumination. For every person there was a limit to the degree of skill attainable, and this applied also to his own investigations. Although the necessity for glasses in certain cases was emphasized, there were people who could obtain no increase in output or improvement in quality when furnished with glasses, because they had already reached their limit in manual dexterity. For the same reason an increase in illumination might also produce no apparent advantage. This consideration should be kept in mind in all investigations where the relation between illumination and output was being examined.

The PRESIDENT, on behalf of those present, thanked the authors for their contributions, which had led to a most useful and instructive discussion.

The Year's Progress in Illumination*

IN the introduction to this report reference is made to the feats of Col. Lindbergh and other world flights, which have greatly stimulated public interest in the lighting of air routes and aerodromes. Another topic that has captured the public imagination is the prospect of television, whilst the synchronization of music with films marks another milestone in applied research.

The birthday of the electric lamp is assumed to be October 21st, and the event has been celebrated by special wireless broadcasting in Italy, Spain, Japan, and other countries.

The disaster in Florida emphasized the value of acetylene portable outfits in reconstruction work, and reminded people that occasions still arise when highly systematized methods of lighting may fail and emergency devices become of paramount importance.

After this brief review of recent events the report continues with a discussion on progress in electric incandescent lamps.

Electric Incandescent Lamps.—Exclusive of flashlight, automobile, Christmas-tree and other miniature lamps, the consumption in America of incandescent lamps during 1926 reached 294 millions, an increase of 11.8 per cent. over the previous year. With regard to lamp sizes, the most notable change in 1926 was the relative increase in the demand for 60- and 100-watt lamps, and a reduction in the demand for the 75-watt. Canada's consumption of large lamps was approximately 15 millions in 1926, and that of miniature lamps approximated to 4.4 millions. Great Britain consumed 15 million electric lamps in 1916 and 36 millions in 1925. In 1925 the output of metal-filament and Nernst lamps in Germany reached about 78 millions, as compared with 71.5 millions in the previous year. Russia is making efforts to increase the output of lamp factories to 67,000 daily. It is anticipated that the demand will increase from 19 millions in 1926 to 31 millions in 1926–1930.

To meet the conditions of rough service two 50-watt tungsten lamps have been designed in the U.S.A., one with an inside-frosted bulb and an initial efficiency of 8.7 lumens per watt for use of drop cords or as a "trouble lamp," the other in a clear bulb, with different filament mounting and an initial efficiency of 10.3 lumens per watt, for use where there is considerable vibration. Sixty- and 100-watt inside frosted units have replaced the 50- and 75-watt clear glass "daylight"-blue bulb lamps formerly listed.

The revised Government specifications for the purchase of incandescent lamps require a direct measurement of the lumens per watt. To deal with this and other changes improvements have been effected in the equipment of the Bureau of Standards used for lamp testing.

A test of the emission from a 1,500-watt gasfilled tungsten lamp, as used for therapeutic purposes but without the reflector, showed an extremely small ultra-violet radiation. Practically all radiation of wavelength longer than 3μ and all longer than 4.5μ was absorbed by the bulb of clear glass.

Arc Lamps and Vapour Lamps.—A new yellow-flame enclosing-globe arc lamp which burns for 120 hours with one pair of carbons has been constructed. It has an efficiency of .27 watts per mean lower hemispherical Hefner candles or 20–30 lumens per watt. Lamps available for medical work are now obtainable in large variety. A study has been made of the characteristics of an arc between tungsten electrodes in an enclosing bulb containing neon gas. The conclusion reached was that the tungsten arc is not specially economical, but its light distribution approximates to that of a point source. A gaseous discharge tube lamp has been reported, which operates on 3,000 to 5,000 volts and has special electrodes "containing a substance with a radium base."

Special Lamps.—A "giant flashlight," 14½ inches long, is designed to throw a beam 1,000 feet, and takes five-unit dry cells. It embodies the standard ring hanger safety lock-switch, octagonal lens ring and bevelled lens of the smaller flashlights.

An auto lamp, having two lamps in the reflector, uses one for the main lighting beam and the other as an auxiliary. The latter is fed by a dry battery in the lamp casing, and is intended to serve in case of breakdown, or during ordinary garage repair work when the entire unit is removed and used as a portable lamp. Tests made with a special equipment devised by the joint committee on headlighting of the American Illuminating Engineering Society, the Bureau of Standards, and the Society of Automotive Engineers have resulted in two compromises being suggested. One governs the placing of a fixed headlight beam system so that the axis of the system lies between a position high enough for illumination of the road and low enough to avoid the eyes of an approaching driver. The double-filament lamp for producing the depressible beam is also developing in England and Germany.

Traffic Control.—The partial-platoon method of timing traffic-control signals seems to be growing in favour. A central system governs all signals, and on any one street the signals are divided into groups of one, two or three, with the colours reversed in every other group. A system worked out for Manhattan replaces all centre traffic lights and towers with side-arm lights fastened to poles at the curb line. A further change is the abolition of lights at each intersection and the placing of them at intervals of four blocks. The system used at Oakland, California, specially considers the pedestrian. It has the usual three lights—red at the top for "stop," green at the bottom for "go," whilst the amber centre light is plainly marked "ped'n."

Light in Aerial Navigation.—The following have been given as the requirements for special night-flying equipment of aeroplanes: three navigation lights, one on each wing tip and one on the tail to enable pilots to see other ships *en route*; two large headlights more powerful than the automobile type for landing in emergency fields not equipped with floodlights; two large magnesium parachute flares, one of which will light a square mile of area brilliantly from an altitude of 2,000 feet.

A new revolving searchlight has been put in operation 19 feet above the top of a tall building in St. Louis. It is intended to help aeroplane pilots over a radius of 150 miles, has a 30-inch beam, is rated at 300,000 candlepower, uses 1,800 watts, and has two speeds, either two or ten revolutions per minute.

Experience has shown that the floodlighting of aviation fields requires a beam of light covering the entire area, with a small vertical divergence and a very sharp cut-off at the top, this being 11 feet from the surface of the field, and so close to it that in landing towards the light the pilot will not be dazzled, nor will the wings throw shadows until the landing is effected. A 180°-floodlight which fulfils these conditions has the front half of a drum-like housing filled with a 180°-Fresnal lens about 3 inches high and 3 inches in diameter. It throws a beam with a vertical divergence of 1½° to 2°, and has a horizontal divergence of 180°.

As intermediate light sources on aviation routes small acetylene flashing beams are of considerable use. Equipped with sun valves, they operate automatically for six months or more, and a quick flash ensuring attention can be obtained. Such beacons were installed every three miles on the transcontinental air mail route.

Special Application of Light.—Following the adoption by the Trinity Brethren of the incandescent electric lamp as their standard for the illumination of lighthouses and lightships, four of the principal lighthouses around the British Isles and two or more lightships have been in process of equipment. Lamps of the 3,000- and 4,000-watt gasfilled type are being used, and experiments with the 10-kw. size have been undertaken.

* Some Notes on the Report presented by the Committee on Progress at the Twenty-first Annual Convention of the Illuminating Engineering Society (U.S.A.).

A 30-inch unit on an hotel roof in Worcester, Mass., is used to warn patrolmen when bandits are operating, and to call them to the nearest patrol box for instructions.

To obtain higher screen intensities in the moving-picture theatre, attempts are being made to use the high-intensity 40–60 ampere arc lamp in the mirror arc system, using horizontal carbons. The incandescent lamp used for high-intensity projection work has been provided with a mirror, the function of which is to bring an image of the filament to a focus in the plane of the filament and between the coils. A portable light for cinematograph work uses two magnesium ribbons, burns for 30 minutes, and is claimed to produce an intensity of from 5,000 to 6,000 candle-power.

A giant sky projector, designed to throw letters and pictures on clouds, uses a high-intensity arc of the type used in searchlights, and is claimed to have 400 million beam candle-power.

Frosting of miners' lamps has recently been resorted to, and a new lens, or well glass, which has inside vertical prisms only, has its inner side lightly satin-finished. Special parabolic reflectors, one above and one below, have been incorporated in a miner's lamp with the object of increasing the luminous intensity. The light source is at the focus of the reflectors, the top one of which increases the intensity by 31 per cent. and the lower one by 13 per cent., the total increase being 44 per cent.

Street Lighting.—After two years of work a Committee of the B.E.S.A. has drafted specifications for street lighting. Streets are divided into seven classes, graded according to the minimum rated test-point illuminations, which are 2, 1, 0.5, 0.2, 0.1, 0.05, and 0.02 foot-candles. The series of minimum heights specified runs from 30 feet to 13 feet. A further requirement is that post spacing must not be less than twelve times the height of the post.

A comparison of 79 cities in Germany in 1914 and 1926 showed that out of eight cities with populations over 100,000 only one had increased the street lighting since pre-war days. There was an increase of 6 per cent. and 4 per cent. in the number of gas and electric lamps respectively.

Festival Lighting.—During the 1927 carnival season at New Orleans the illumination is said to have surpassed all previous efforts in that direction. In celebrating the sixteenth anniversary of the Confederation of Canadian provinces the country for miles around was illuminated by powerful apparatus installed on towers and other high points. Natural Bridge, the famous 90-feet limestone arch near Lexington, Virginia, has been illuminated, and Chimney Rock, one of the great natural curiosities and a landmark of North Carolina, has been floodlighted.

The electrically lighted outdoor Christmas-tree is growing in favour, and in some cities has become quite a community affair.

Attention has been drawn to the advantage of strip lighting, particularly in colour, as a means of accomplishing what is usually done by floodlighting. It entails low expense, and can be taken care of on the building itself. An analysis of floodlighting schemes in London reveals the fact that dirty brick, concrete or stone require, as a rule, too much light to be practicable. The illumination required varies from 2–5 foot-candles for white glazed brick to 13–33 foot-candles for granite. Signs and hoardings run from 5–25 foot-candles for ordinary posters on mat surfaces, the figures being increased by 10 per cent. for glossy surfaces and posters with intricate designs.

For railroad classification yards an illumination of 0.1 lumen per square foot is recommended, and for receiving and departure yards a range of 0.06 to 0.15 is mentioned.

Miscellaneous.—A form of illuminated sign introduced in England depends on the use of a series of enamelled-metal "shutters" illuminated by light emitted through the interstices between the individual inclined strips. Thus the source of light is concealed from the eye.

Experiments on the daylighting of interiors in Germany have led to the conclusion that the useful flux of light in general amounted to about 40 per cent. of the flux of light transmitted through the window, a utilization factor not far from that of artificial light. Three hundred foot-candles for exterior illumination was suggested as corresponding to sufficient indoor illumination under normal conditions.

The new hall of an old hotel in England which has been rebuilt can be changed over in 15 minutes from a theatre for moving pictures to a ballroom or a restaurant. The lighting needed was both decorative and flexible, and coloured effects were also required. The illumination averages 4 foot-candles at the floor, with an energy consumption of 1.5 watts per square foot of floor area.

Cornice lighting has been used for the new council chamber of the Delhi Assembly in India. The detail of the stone fretwork ceiling is well brought out, and the illumination on the desks is about 4 foot-candles, with a consumption of approximately 45 watts per running foot of cornice.

More interest in school lighting is being displayed by authorities in England. In Sheffield five schools have been refitted with complete and up-to-date installations.

A military college in Mexico has adopted a modern system of lighting. The main lighting of the auditorium is provided from a cornice between the wall and the ceilings, which contains more than 200 lamps and reflectors.

Some of the novel possibilities of lighting have been applied in a New York night club. The table tops are of glass, which under ordinary lighting looks like a mirror. When the lights are dimmed a fish bowl is revealed underneath. The floor is also of glass, which can be lighted in any colour from below.

As a result of experiments carried out with a model of one of the tubes of the new Holland Tunnel under the Hudson River at New York City, it was found that the best illumination was obtained with deep bowl reflectors having a parabolic surface, mounted in line with the wall at an angle of about 20° to the vertical and provided with diffusing-glass covers. The units are 150-watt clear-glass bulb lamps spaced 20 feet apart. The average intensity on plane 24 inches above the roadway is 1.22 foot-candles, with 0.75 watt per square foot of road.

Floodlighting has recently been adopted in a coal mine in America. To light the face of the vein where mining is going on, a special 1,000-watt 220-volt direct-current portable floodlight is used.

To meet the need for a small portable light, as in meter reading or photographic development, a little holder has been designed. It can be held in the mouth, and the switch can be operated by the teeth, thus leaving both hands free.

The illuminated house number is now attracting wide-spread attention, and in Helsingfors, Finland, it has now been made compulsory.

New Photometric Apparatus, etc.—For measuring the small light emission met with in phosphorescence, meteorology, etc., a device called a "thermo-photometer" has been adapted for general use, thus avoiding the necessity of building special apparatus. Another portable photometer has also been designed for measuring low luminosity, particularly that of radio-active materials. A small lamp in a cylindrical container, capped with a piece of milk glass, is used as the basis of the comparison source. The light from an incandescent lamp falling upon the cathode of a suitable discharge tube containing one of the rare gases results in flashes being produced. As the mean of the number of flashes per second has been found to be proportional to the intensity of the incident light, this fact has been used as the basis of a new photometer. It has been suggested that this might be employed for the measurement of very small intensities of ultra-violet radiation.

It has not so far seemed possible to eliminate all the difficulties inherent in the selenium cell, although they can be compensated by certain arrangements.

Further Messages to the Special Twentieth Anniversary Issue of "The Illuminating Engineer"

(The following messages were received after our Twentieth Anniversary Issue had gone to press. We reproduce them now as further generous and kindly references to the work of the late Mr. Leon Gaster, the Founder and Editor of this Journal during 20 years.—ED.)

Dr. Hans Koch (*Vienna*):

THE VALUE OF INTERNATIONAL CO-OPERATION IN THE FIELD OF ILLUMINATING ENGINEERING.

Progress in illuminants, conceptions of illumination and practical applications of light may be said to characterize three epochs in illuminating engineering. Their beginnings may be traced to the earliest times. But it was only during the last century that their importance began to be fully appreciated in an age of electrical energy, with its almost unlimited possibilities and manifold advantages to mankind.

Whilst the precedence of America may be recognized in the introduction of the first practical electric lamp by Edison, yet earlier experiments in this field had already been made in many countries. The international importance of these researches became evident as the scientific principles underlying light production were better understood. Further experience of electric lamps led to the study of their correct usage in practice. Whilst some degree of intercourse was attained, it was only later that the need for more regular international exchange of experience became manifest, and illuminating engineering began to be actively studied in almost all countries.

In the year 1900 the first step towards international co-operation was taken in the founding of the International Photometric Commission, which in the year 1913 underwent a considerable extension on a broader basis as the International Commission on Illumination. How needful such international co-operation was felt to be is shown by the revival, after the war, of this Commission, in which an ever-increasing number of representatives of different countries took part. In 1927 there were nearly 70 delegates, representing 10 nations.

International exchange of thought is necessary not only on theoretical and scientific aspects of illumination (e.g., units of light, nomenclature, etc.), but also on many practical problems (such as automobile headlights, etc.), in order that a common understanding may be attained and ultimately recommendations made. Whilst the need for international discussion was thus met, yet it must be recognized that the intervals between these international conferences are too great to facilitate regular contact between those in different countries interested in lighting problems. But a valuable medium for exchange of thought is afforded by the technical press, and in this connection one thinks first of *The Illuminating Engineer* (The Journal of Good Lighting), which is now celebrating its twentieth anniversary. Founded at a time when illuminating engineering was in its infancy, it has assumed the duty of spreading abroad a knowledge of theoretical researches on illumination, and to-day stands out as a journal which can serve as a medium for international exchange of views on illuminating engineering.

I gladly make the attaining of this twentieth anniversary the opportunity of conveying my most cordial good wishes to the founder and editor of this journal, and of expressing the hope that its international connection will be yet further extended, in the interests of all concerned with illumination.

Mr. Thomas A. Edison (*United States*):

It gives me much pleasure to learn that your publication has completed a second decade, and that you are about to issue a Special Twentieth Anniversary number. It must be a source of satisfaction to you, after passing through the many vicissitudes of journalism to have reached your twentieth year of increased activity. It must be a source of gratification to you to look back on the preceding years and realize that you have occupied a position of usefulness and honour in the electrical world.

I congratulate you, and trust that your onward march will be signalized by the success which you have heretofore attained.

Mr. S. E. Doane (*National Lamp Works, Cleveland, U.S.A.*):

You have been a persistent pioneer in illuminating engineering, and your work, added to the work of other individuals who have knowledge and application of light, have together built a great industry.

I offer you and your organ, *The Illuminating Engineer*, my very sincere congratulations.

Dr. Clayton H. Sharp (*Past President of the Illuminating Engineering Society, U.S.A.*):

I wish to congratulate you most heartily on your forthcoming twentieth anniversary of *The Illuminating Engineer.*

You have put in 20 long years of hard work for an important cause and, in my judgment, you have been very successful. *The Illuminating Engineer* has always been a very readable journal, and now, in its twentieth year, is no less so than it has been in the past.

What tremendous strides the good-lighting movement has made during these twenty years! The progress has been so gradual and so uniform that we have not realized it fully, but if we were to be put back to the conditions of 20 years ago we would find things very dismal, I am sure. The progress which has been realized must be a source of satisfaction to you, which you well deserve, and which nothing can take away from you.

Mr. M. Luckiesh (*Past President of the Illuminating Engineering Society, U.S.A.*):

Anniversaries provide us with an opportunity to put into words the appreciation and interest which we hold for those directly concerned in the event. A decade ago it was my privilege to congratulate you upon ten successful years as Editor of *The Illuminating Engineer* and as Honorary Secretary of the Illuminating Engineering Society. At that time I was wholly occupied with a retrospective view of your work, and if I looked ahead at all it was with confidence that your success would continue.

Now another decade has passed, and you should feel proud and satisfied with the continued progress of the *Journal of Good Lighting*, which is due so much to your ability and sincerity. It is particularly gratifying to me to note your unbiassed attitude and complimentary manner towards our work in the United States. These friendly relations are of far-reaching value outside our own sphere of direct interest. I am sure you look back over 20 years with much pride and satisfaction. I congratulate you and your journal on these accomplishments and extend my best wishes for the future.

Dr. M. Bohm (*Milan, Italy*):

Special circumstances have prevented me from responding earlier to your letter, and it is therefore possible that this may arrive too late for publication.

I should, however, like to add my words of congratulation on the completion of the 20 years of glorious life your journal has achieved, and to express my belief in a still finer future.

The treatment of scientific and technical articles dealing with light and the popularization of the study of modern problems in illumination, whether in connection with safety, hygiene or economy, which has been the special work of your publication, are objects of great value and of universal benefit.

Dr. E. C. Crittenden (*Past President of the Illuminating Engineering Society, U.S.A.*):

With most cordial appreciation I congratulate *The Illuminating Engineer* on the completion of 20 years of service to the cause of good lighting. On this side of the Atlantic we value your journal very highly, not only as an exponent of the notable progress which is being made in Great Britain but as a link which connects us with lighting activities on the Continent as well.

I have been especially interested in the recent discussion in your columns on methods of making the International Commission on Illumination more useful. We hope that the coming meeting of the Commission in America will continue the progress in this direction which has been so well begun under the auspices of our friends in Switzerland and in Italy, and which has been so ably furthered by your support.

As an agency of international understanding, I am sure that *The Illuminating Engineer* has before it an era of still greater usefulness. Friendly competition in the development of technical knowledge and commercial application of light is evidently growing keener year by year, and your enviable reputation as a purveyor of news that is both readable and reliable makes your journal the natural channel for the exchange of ideas in this field.

With best wishes for continued success of your efforts to give us a real journal of lighting.

Dr. L. Carozzi (*International Labour Office, League of Nations, Geneva*):

It is with the greatest of pleasure that I take this opportunity of expressing my sympathy with the objects of *The Illuminating Engineer* and presenting my congratulations on its Twentieth Anniversary. I already had the pleasure on the occasion of its Tenth Anniversary of associating myself with the good wishes expressed on its behalf, a proof that I have had the privilege of being for long years in cordial relations with the journal and the Society, which, not only in Great Britain but in all civilized countries, has led the movement in favour of the progress of illuminating engineering.

Credit is in great measure due to the Society and to the publication in question for the truly important progress already achieved in all branches of illuminating engineering, and in particular in regard to industrial lighting. The ideal standard aimed at has, perhaps, not yet been attained, but the explanation for this lies simply in the complexity of the problem and the technical difficulties to be surmounted. It is indeed a matter of congratulation for *The Illuminating Engineer* and its Editor to have induced experts on hygiene to accept illumination as a question of importance equal to that of ventilation and heating.

I offer *The Illuminating Engineer* my heartiest wishes for increased success and wider circulation.

We give below one of the first messages received following Mr. Gaster's death, which was dispatched to Mr. C. C. Paterson by **Dr. Teichmüller**, the President of the Lichttechnische Gesellschaft in Karlsruhe:—

I have just heard of the sudden death of Mr. Leon Gaster. The news has grieved me exceedingly; I recognize what a great loss the Illuminating Engineering Society has sustained in the death of this indefatigable and eminent worker, whose many-sided and deep knowledge has been placed at the service of your Society for so many years.

I should be grateful if you would convey my deepest sympathy. I shall always hold in honour the memory of Mr. Gaster, whom I have known for many years and esteemed very highly.

The Mechanical Strength of Metal Filament Lamps

In a paper on the above subject, read at the Leeds meeting of the British Association, Mr. F. Murgatroyd mentioned some interesting facts. After referring to the principles involved in the construction of the gasfilled lamp and explaining the necessity for a spiral filament, he pointed out that this form of filament was not necessarily stronger than a straight one.

In order to protect lamps against shock and vibration two chief expedients have been adopted. Existing types of anti-vibration fittings fall into two main classes. In one design the lampholder is attached to a number of strips of phosphor-bronze gauze, so that the lamp has a certain amount of flexibility in a direction along the lamp axis. This device damps out continuous vibrations of small amplitude and definite frequency. But the gauze transmits momentary shocks.

In another type of fitting both the lamp and the lampholder are held in an arrangement of springs. A lamp so held tends to respond to vibration, and when resonance occurs the lamp is strongly vibrated. This spring fitting nevertheless withstood the effect of violent shocks better than the gauze fitting, the springs damping the shock to some extent.

It is desirable, however, that incandescent lamps should be sufficiently robust to withstand shock and vibration, and the use of anti-vibration fittings is an acknowledgment of their weakness in this respect. Hence, even if an ideal anti-vibration fitting could be evolved, it would tend to retard rather than to assist the wheels of progress.

The crystalline structure of the tungsten filament has an important bearing on mechanical strength. There is weakness of the crystals themselves; there is also weakness at the amorphous junctions of the crystalline boundaries. Some interesting results have been obtained by means of a shock-testing machine. The main facts established by these tests were (1) that a lamp is weaker when burning than when cold, (2) that the presence of gas does not add to strength in a gasfilled lamp, (3) that spiral filaments are not necessarily stronger than straight ones, and that the chief factor is the structure of the filament material. Several of these conclusions are in opposition to views generally held. Many people, for instance, have been under the impression that a lamp is liable to suffer more from shock when lighted than when cold, and it has often been held that spiral filaments are stronger than straight ones—hence their adoption for certain forms of traction vacuum lamps. This view is believed to have no foundation in fact.

Moreover, the spiral filament is liable to give trouble by sagging, and this tendency is accentuated by vibration. The addition of thoria to filaments has had a beneficial effect in limiting sagging, owing to the restraint of crystal growth, but it cannot be said that the sagging trouble has been entirely overcome. In view of the fact that spiral filaments are used in gasfilled lamps manufacturers may, at some future date, seek to standardize the spiral filament for all forms of lamps. The author suggests, however, that this should not be done before all objections associated with the spiral filament have been overcome, and especially before the low-consumption gasfilled lamp is an established success.

Electrical Engineering in Japan

We have this month been favoured by copies of another Japanese technical publication, the journal of the Electrotechnical Society of Waseda. The copies contain contributions covering a wide range of topics, and it is probable that some of them would be of considerable interest to British engineers. Unfortunately, the text of the articles is in Japanese, though the titles of the most important articles are given in English. It would be a useful step if English abstracts of the contents of the chief papers could be included.

POPULAR & TRADE SECTION

COMPRISING

Installation Topics—Hygiene and Safety—Data for Contractors—Hints to Consumers

(The matter in this section does not form part of the official Transactions of the Illuminating Engineering Society; and is based on outside contributions.)

The Maintenance of Electric Signs

By H. LINGARD

(E.L.M.A. Lighting Service Bureau).

MAINTENANCE of lighting equipment is always, unfortunately, an activity in which practice lags somewhat behind theory, and in view of this weakness in human nature, lighting equipment in successive stages of development has not only improved in luminous output and efficiency but has consistently been designed to require less attention. Thus, in the short period of 50 years we have evolved from the unpleasant daily task of cleaning, trimming, and filling the oil lamps of the Victorian era, to the employment of light sources which operate without attention for a period of 1,000 hours, while the modern totally enclosed unit, specially designed as it is to obviate the collection of dust, requires the minimum of cleaning.

Cleaning of Signs.—Illuminated advertising, however, being largely a modern innovation, has, on the whole, improved little in this respect, and in view of the increasing competition in this field of publicity regular and thorough maintenance is an absolute necessity if the relatively high initial cost of an illuminated sign is to prove a satisfactory investment.

Granted that outdoor publicity is subject to conditions which are distinctly adverse from the point of view of cleanliness, then the healthy reaction should surely be an energetic and regular system of maintenance to combat this apparently (for the present time) inevitable disadvantage.

The problem is necessarily one which is more or less acute, depending on the type of sign employed, and it will probably be worth while, therefore, to review briefly the different types of signs at present in favour, and their demands from a maintenance point of view.

Trough Signs.—The trough letter sign is still by far the most frequent type of sign in use, particularly where animation is incorporated, and the requirements of this type of construction are, therefore, of considerable importance. With very few exceptions, the interior surface of trough signs is finished in white stove enamel, providing thereby a reflecting surface which is substantially permanent and very easily cleaned with soap and water, or even a damp cloth where the cleaning periods are reasonably frequent.

Care should be taken not to employ excessive quantities of water, otherwise the lampholders may suffer damage due to frequent inundations.

Box Signs.—The box type of sign employing opal or coloured glass panels is one in which regular cleaning results in a great improvement in appearance. The brightness of opal glass letters may be reduced to one-fifth or less of the original new brightness by accumulation of dust and grime in an average city street in the course of a year.

Cleaning regularly will maintain the sign very nearly up to 100 per cent. brightness, and as signs of the box construction are usually furnished with hinged panels so that the lamps and interior are easily opened up for cleaning, their maintenance is not an unduly onerous task.

Outline Signs.—Another type of signs which is becoming increasingly popular consists of an opaque letter (usually gilded) which is thrown up in relief after dark either by virtue of a surrounding margin of troughing or by appearing as a black silhouette against an illuminated background. In either type the lamps which provide the illumination are not seen directly from the front, but are housed in the back surface of the letter itself.

These signs have an especially excellent daylight appearance, as the front surface of the letter is not spoiled by unsightly lamps or lampholders. Since this type of sign depends for its effectiveness at night on the light reflected from a background, it follows that to maintain a distinctive and arresting brightness the interior of the letters must be cleaned regularly, and realizing this necessity the designers usually incorporate a device whereby the letter itself can readily be removed from the background for cleaning and inspection.

"Dark" Circuits.—Even in these enlightened days it is not an uncommon thing to encounter exposed lamp signs with a number of gaps in the lettering, due presumably to some of the lamps having concluded their useful life. There seems some excuse for this fault where the sign is situated in some very inaccessible situation, but, on the other hand, it is on the whole a bad policy to replace lamps here and there as they burn out, especially as some considerable expense may be involved in reaching the sign. A preferable method is to keep a record of the burning hours of the lamps, and when they begin to get towards the end of their life and one or two fail, to select that time for cleaning, overhauling *and replacing of all lamps.* It will often be found that the small fraction of life that is left in the lamps is of considerably less importance than the cost of renewing numbers of lamps at frequent intervals as they burn out.

Switching.—There is little need to stress the importance of switching on and off the sign at the most suitable times, as a large number of the more important signs are controlled by time switches which automatically advance and retard the lighting-up time in accordance with the season, and apart from an occasional inspection and winding these devices require a minimum of attention.

Flashers and Contactors.—The entire success of an animated sign depends on the efficient working of the flasher or contact mechanism; a very little wear in the brushes, a loose connection, or a slipping belt may make all the difference between a display which is perfect and one which is entirely unintelligible.

Flasher maintenance is, therefore, of prime importance, and the mechanism should be inspected about once a

week. The timing of the contacts, on which the sign depends largely for its effect, should be frequently checked and the brushes advanced to compensate for wear.

At least once a month all bearings should be oiled, grease cups filled, and bolts, nuts and connections should be inspected and tightened. High-speed flashers are subject to excessive vibration, and more frequent inspection of connections, etc., is needed.

Æsthetic Considerations.—There is an increasing tendency towards making electric signs more beautiful and more in keeping with the dignity of their surroundings, as it is being realized that the impressions from beautiful objects persist in the minds of the public and leave feelings of friendliness which work to the advantage of the advertiser.

As a result, the curt and ugly types of signs which often too thinly veiled the selfish aims of the advertiser, are now falling into disuse.

It is hardly necessary to point out in concluding this article that the appreciation of the importance of considering electric signs, from an æsthetic standpoint, renders some efficient system of maintenance absolutely essential; a dirty sign is an eyesore, however well designed and mounted it may be.

Scottish Electric Lighting Service Bureau

SECOND ANNUAL REPORT.

The second annual report of the Scottish Electric Lighting Service Bureau, now before us, contains evidence of extending work, which appears to have been economically conducted. The busy season for lectures and demonstrations coincides with the six to eight months of the lighting season, and the summer is devoted mainly to preparations. During the second year the attendance at lectures, etc., arranged under the Home Lighting Campaign Scheme, exceeded 1,000, and there were over 2,000 persons who either attended meetings, called for advice, or attended lectures elsewhere. In all it is estimated that over 3,000 people were reached by the second year's activities. A check has been made on the shoplighting survey conducted by the Lighting Service Bureau in London, and a considerable improvement in lighting conditions was noted. The outlook for future work is bright, and financial support has been well maintained. An Illumination Design course has recently been given at Edinburgh, and the District Secretary is acting as Lecture Secretary for the Glasgow Circle under the 1927–28 Electrical Development Scheme; this is resulting in further lectures on illumination and other electrical subjects.

For the benefit of readers of this journal in Glasgow and the vicinity we may recall that the Scottish Lighting Service Bureau has its headquarters at 20, Trongate, Glasgow, where excellent arrangements for demonstration purposes exist.

Sheffield Illumination Society

The first lecture of the 1928 session was given on January 10th, in the meeting-room of the Y.M.C.A., Fargate, when an address on "Time Switches" was given by Mr. E. E. Sharp, of Venner Time Switches Ltd. Electric time switches for the control of street lighting are new to Sheffield, having only been introduced since the appointment of Mr. J. F. Colquhoun as Lighting Engineer to the Corporation. Mr. Sharp mentioned that time switches were used for the first time for controlling street lamps at Hastings. This was about 21 years ago, but some of the fittings are still "going strong." Important advances have been made since then, and to-day there are available switches capable of controlling currents approximately 750 times as strong.

The lecturer subsequently gave a descriptive account of modern types of time switches, emphasizing various important points in maintenance. Only oil of very fine quality should be used. The lasting capacity of the oil used is at present about 12 months, but experiments now being made in Switzerland may extend this time to 10 years.

Some Gas Lighting Installations

The accompanying illustrations give some indication of the efficiency of modern gas lighting fittings for the illumination of offices, corridors, halls and business premises. It will be noted that every fitting is properly shaded.

This is one of the most beautifully lighted dancing and dining halls in London. Each of the ten pendants in the centre of the room has a superheater burner with a cluster of seven No. 2 size mantles. The burners are lighted and extinguished separately by the turning of distance-control cocks situated in the small cases to be seen near the doors on each side of the platform. Fixed on the walls are 14 two-arm gas brackets, one of which is shown in more detail in the small illustration below. These brackets are turned on and off in pairs (on the "hit-and-miss" plan) by distant-control devices. The pendants and the brackets are shaded with silk of an orange colour, which imparts a pleasant mellow glow to the room, and eliminates all glare.

One of the gas wall-brackets used in the room shown above. These were specially designed by an architect and are made of cast brass finished in a light bronze colour. Each of the two burners has two No. 2 size mantles. The distance-control device is enclosed in a small box incorporated in the central design of the bracket. The sides of this box can be removed easily.

A corridor leading to a series of model rooms in a London showroom. This is lighted by single-burner gas brackets, with silk shades of a simple design and of a colour suitable for the rooms opposite which they are placed. Thus the shades facing the kitchen and bathroom are white, and those facing the library, bedroom and dining room are respectively green, rose and red. Silica-ware cylinders are fitted to each burner. The metalwork of all brackets is brass with oxy-silver finish, and each burner has a No. 2 size mantle.

A six-light ventilating gas lamp, with a 16-inch semi-opaque bowl, is used for the main lighting of this showroom. The mantles used are No. 2 size, and are clustered under a superheater. This light draws up the used air from the room and sends it into a duct, from which it is discharged into the open air by mechanical means. Thus the air in the room is always fresh. The lamp is lighted and extinguished by the operation of a control cock placed in a convenient position. In addition, there are four one-light gas pendants with silk shades of a pleasing colour. Over the various fireplaces single-burner gas-lighting brackets are placed, and these are fitted with silk shades of attractive design.

Some Gas Lighting Installations

A notable improvement in the external design of gas lighting fittings has taken place during the last few years. In the less expensive types of fittings the tendency is to eliminate all superfluous ornamentation.

A large office lighted by modern gas fittings. Semi-indirect gas lighting pendants are used for the general illumination of the room, and these are individually controlled by switches. On each glass-topped desk are two fluted desk standards, fitted with double shades. The inner shade is made of silica ware and is white. The outer shade is of dark-green glass. These two shades are so arranged that a current of cold air passes between the inner and outer one, thus minimizing the possibility of heat breaking the glass shade. Hanging from the edge of each shade is a green silk fringe. Each standard has a superheater gas burner with two No. 2 size mantles. The columns are 2 feet high, and the mantles are about 2 ft. 9 ins. above the level of the desk. The illumination on the desks is very even.

An excellent example of corridor lighting by semi-indirect gas-lighting pendants specially designed to harmonize with the surrounding architecture. The pendants have lunastone bowls and superheater burners, with clusters of six No. 2 size mantles. Each burner is separately lighted and extinguished by the operating of a distance-control switch. At the end of the corridor, in front of a War Memorial tablet, are two very beautiful cast bronze standards, with superheater burners, clusters of three No. 2 size mantles, and semi-opaque pear-shaped globes.

A near view of one of the cast bronze gas candle brackets, some of which can be seen in the background of the illustration below. The burner has an inverted No. 1 size mantle fitted below a small superheater. The fringed shade is of watered silk. The fitting is equally suitable for drawing rooms or for fixing on panelled walls.

A system of gas lighting suitable for banks, or for reception rooms and showrooms in large stores. Lunastone bowls are used, and the number of mantles in each fitting can be varied in accordance with the amount of light required. The lights are controlled in series by means of switches, some of which can be seen on the pillars on the right of the illustration. A close view of the artistic silk-shaded imitation candle gas brackets on the pillars in the background is given in the small illustration above. The lights on the counter (which were turned off when the photograph was taken) are fitted with shades similar to those provided in the office shown at the top of this page.

"Brighter" Church Lighting at St. Peter's, Woolwich

THIS Catholic "Church of St. Peter, Prince of the Apostles," is situated in New Road, Woolwich, on a site opposite the Grand Depot Barracks, granted by the Board of Ordnance in perpetuity in 1841. It was built from the designs of the great architect, Augustus Welby Pugin, and opened in 1843. It is 140 feet long by 62 feet wide, and of the decorated style of architecture after the period of Edward I., with a number of lofty stone arches and pillars of imposing design. The tracery of the windows is particularly fine, especially that of the large western window, which measures some 24 feet by 16 feet. A rare feature of church architecture is also to be found in the tracery of the remaining 20 windows, each of which is of different design. The pillars, walls and ceilings of the nave and aisles are finished in primrose colour, which causes the Elizabethan style of woodwork supporting the roof to stand out in sharp relief.

By reason of this the interior of the church failed to lend itself to orthodox forms of ornamental and decorative lighting units, and a scheme of direct and reflected lighting was therefore designed by the G. E. C. Illuminating Engineering Department, in collaboration with the Rev. Father O'Leary and Mr. A. Browne, of the Woolwich Borough Council Electricity Department, who carried out the installation. Brightness without glare was insisted on, and the scheme ultimately adopted was designed with a view to giving effect to this condition. The result is apparent from our illustrations, the photographs being taken at night solely by the illumination provided by the installation. When illuminated the whole body of the church takes on a brightness, as a church-worker [illegible] phrases it, "akin almost to noonday sunshine," while the intensity in foot-candles taken on a horizontal plane 2 feet 6 inches from floor level reveals an order of uniform illumination rarely approached in church-lighting installations.

FIG 1.—Nave and Chancel of St. Peter's Church, Woolwich, illuminated by "GECoRAY" Reflectors and Floodlight Projectors.

The lighting installation differs fundamentally from ordinary church practice. A large number of GECoRAY reflectors and floodlights, equipped with Osram gasfilled lamps, are used. These are mounted some thirty feet high, fixed in tiers above each other, and directed to throw floods of light in an upward and downward direction. The result is that the whole of the roof is effectively illuminated by the upper tier of units, the reflected light of which blends with the downward light of the lower tier to illuminate the body of the church and the whole of its seating accommodation. This was accomplished by means of installing the units and so arranging and spacing them that the whole of the nave and aisles in the church were bathed in a sea of rich light without a semblance of shadow or dark corners. A slightly lower intensity of lighting prevails in the sanctuary and in the two Lady Chapels, and this has the effect of revealing the beauties of the garniture of the reredos and arches, which stand out in soft outline against the more profuse light prevailing in the body of the church. Even with the ageing of the decorations, lamps, and effects of dust accumulation, the same softness of the sanctuary lighting will obtain in relation to the whole.

The illumination of the chancel and nave is carried out by means of floodlight projectors concealed behind beams adjacent to the roof. Floor floodlights are also installed, in pairs, behind the chancel arch, each accommodating 150-watt white Osram lamps. Six similar fittings are installed in the nave, each being equipped with 200-watt lamps. Ten silvered-glass GECoRAY reflectors with 100-watt lamps are fitted in the roof of the nave, each being of a uniform height of 30 feet from floor level. The direct illumination of the aisles and the indirect illumination of the ceilings of the aisles is contrived by the use of similar reflectors, each equipped with 100-watt white-sprayed lamps.

The statues by the Lady Chapel, the vestry and font are each illuminated separately with larger-type reflectors employing 150-watt lamps wired on separate circuits for switching on as required. The Lady Chapels are illuminated by the same type of reflectors, the larger being equipped with 100-watt and the smaller with 60-watt white-sprayed lamps. Additional reflector units are provided for illuminating the choir stalls at the rear of the church, while specially designed units serve to illuminate the lobby, under-gallery and vestibule. The two entrances are illuminated by new pattern G.E.C. bracket fittings, while the lighting of the vestments and vestries is also carried out in an equally efficient and attractive style.

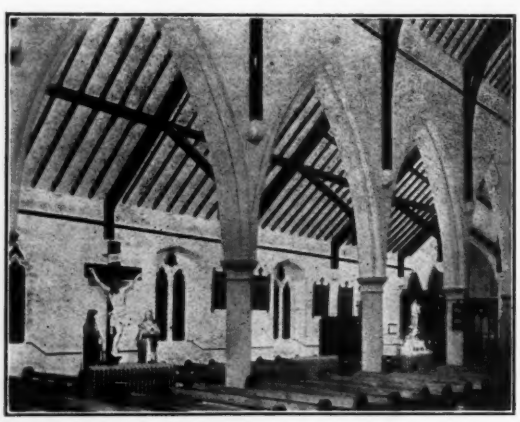


FIG. 2.—View of Nave and Left Aisle of St. Peter's Church, Woolwich.

Many of the units referred to are wired on special circuits for use as needed in different parts of the church. A large wrought-iron lantern, with 13-inch square body and double-rolled cathedral glass panels, equipped with a 200-watt lamp, is installed in the vestibule. Osram lamps are used throughout.

The beauty of the unorthodox system of lighting prevailing in this church has much to commend it, and since it is a radical departure from standard practice it will be interesting to observe whether this new system will spread. Without doubt it will find favour amongst those who have so long preached the doctrine of "making our churches brighter," and it remains to be seen whether the era of the brighter church has really definitely arrived.

TRADE NOTES & ANNOUNCEMENTS

PHILIPS REFLECTOR FITTINGS.

Philips Lamps Ltd., makers of the well-known "Argenta" lamp, who recently placed on the market four types of reflector fittings for use with the "Argenta," have now introduced a new method for adjusting the lamp and holder to the correct position in the reflector, which is on a simple sliding-scale system. This system is fitted to the "A.K." and "A.G." types, in addition to the "N.D."

For the Philips "N.R." fittings no special adjustment is required. In the type "N.R." the lamp is mounted in such a way that the difference between the light-centre length of various lamps used is so small that adjustment is unnecessary.

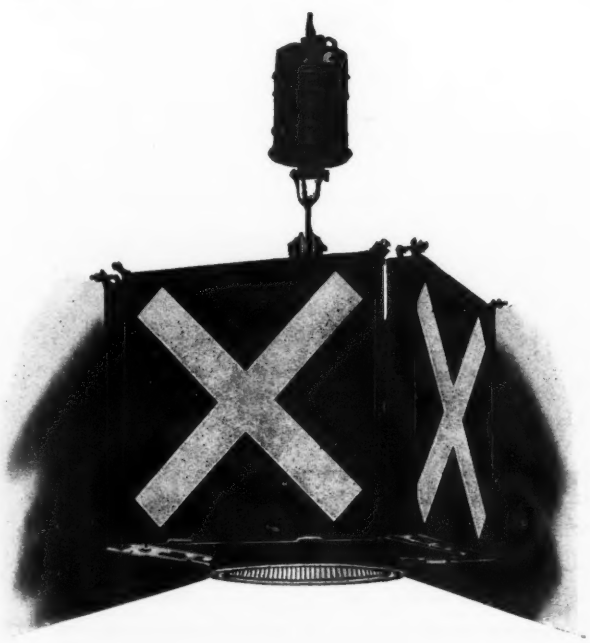
Further particulars of these fittings can be had upon application to Philips Lamps Ltd., 145, Charing Cross Road, London, W.C.2.

A NEW "SAFETY-FIRST" LANTERN.

We have several times referred to the possibilities in the design of luminous safety-first and traffic-control devices which formed a feature at the Exhibition organized by the Association of Public Lighting Engineers last September.

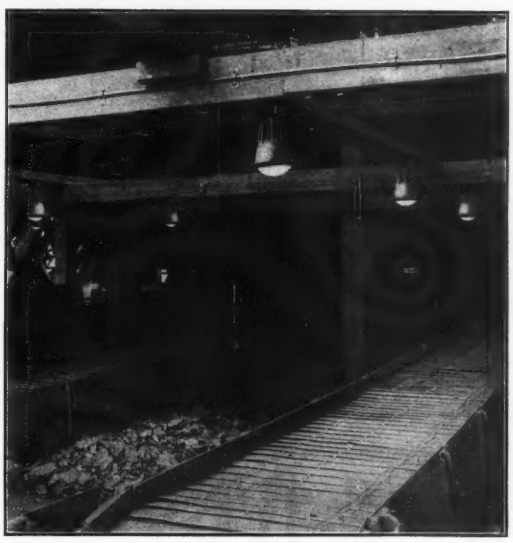
The illustration below shows the latest development of the new K. & M. "Throlite" Safety-First Lantern, which has been designed by Messrs. Korting & Mathiesen Electrical Ltd. The chief features of the ordinary form of this lantern have already been described in this journal. It consists essentially of a combination of the familiar "Throlite" lantern, directing a powerful light downwards, upon which is mounted a separate fitting showing the triangular "safety-first" device.

In the latest form now illustrated, however, the attachment of the cross danger sign consists of four square boxes, each section being illuminated by a 60-watt lamp. The device thus fulfils a double purpose—it affords the necessary extra illumination at cross-roads, and also furnishes a very striking warning sign, which is independently illuminated and stands out very clearly in red light. We understand that the photograph here reproduced, which gives a good idea of the appearance of the sign, was taken only by the aid of the light furnished by the device.



THE LIGHTING OF COLLIERY SCREENING PLANT.

The illustration shows a typical installation of a colliery screening plant, which is illuminated by "Wigan" "H" type pendant fittings. The screening of coal at collieries in recent years has called for particular attention, even illumination being an essential factor, and this has been successfully achieved in the installation referred to by the use of the above-mentioned fitting. The spacing factor adopted is approximately



2 to 1 with 100-watt type units. The fitting is water-tight and totally enclosed, thereby preserving the reflecting surface, and it is fitted with radiating fins to allow of the efficient dissemination of the heat generated by G.F. lamps. A typical sample of this fitting is illustrated on page xi.

CONTRACTS CLOSED.

The following contracts are announced :—

METRO-VICK SUPPLIES LTD. :—

Admiralty; for Met-Vick (Cosmos) vacuum tubular and special lamps.

Great Western Railway; for Met-Vick (Cosmos) gas-filled lamps.

THE GENERAL ELECTRIC CO. LTD. :—

Director of Naval Contracts; for the supply of over a quarter of a million Osram vacuum and gasfilled electric lamps.

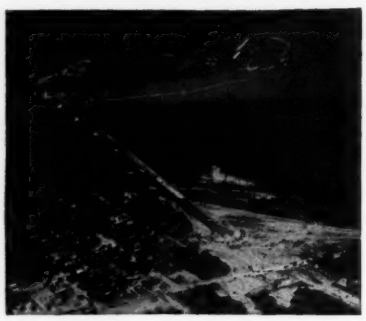
London Underground Railways; this contract has been considerably increased, and now comprises in all 920 traction motors, each of 240-h.p. capacity, and "automatic acceleration" control equipment for 63 motor coaches and 107 trailer cars.

(Whilst, in general, we usually record only contracts for lamps and lighting equipment, the above contract deserves special notice, as we are informed that it is the largest single order ever placed in this country for electric railway motors.)

THE LIGHTING OF THE INTERNATIONAL PEACE BRIDGE CONNECTING BUFFALO AND PORT ERIE, ONTARIO.

The method of lighting adopted for this bridge, which has only recently been opened, has several interesting features. The design co-ordinates two widely different types of light distribution—general diffused lighting for the curved approaches and concentrated direct lighting of the main roadway of the bridge.

The scheme devised utilizes 56 lamps for the curved approaches and 66 lamps along the main straight roadway of the bridge; 4,000 lumens per lighting unit are furnished, but this can be increased to 6,000 lumens if ultimately found desirable. Holophane refractors mounted in Westinghouse ornamental units are adopted on the curved approaches and the straight roadway. Superlux refractors diffuse the light on the curved approaches, and Bilux refractors direct even illumination along the main traffic paths of the roadway on the bridge. The bridge itself is 4,250 feet long, with a total length of one mile, including approaches. The road is 36 feet wide and the sideway 6 feet wide.



Showing Lighting of International Peace Bridge connecting Buffalo and Port Erie.

To ensure continuity of supply, power is furnished both from the American and from the Canadian sides of the bridge. The capacity of the bridge is 3,000 cars per hour in one direction and approximately 1,000 cars per hour in the other direction at the same time. (The calculation is made in this form because the "peak" occurs at different times in the two directions.) The capacity for traffic is, however, somewhat limited by the fact that, as the bridge is an international boundary, both the Canadian and the United States Governments enforce regulations in regard to customs, inspection of cars, immigration, etc. On several evenings vehicles have passed over the bridge at the rate of 2,500 cars per hour.

This heavy traffic naturally rendered the lighting of special importance, even illumination being particularly desirable. Another reason for desiring good lighting is that, owing to the bridge serving as an international boundary, special supervision of all cars is necessary with a view to preventing smuggling of contraband articles—and such examination can only be conducted effectually in a good illumination.

The lighting of special bridges of this character deserves careful treatment, and the experience in this case has some bearing on similar problems in this country.

ERRATA.

Our attention has been drawn to two clerical errors which appeared in our last issue. In the description of the Philips "Duo-Savelite" lamp, on page 32, it was stated that the filaments consume respectively "25 and 44 watts." The latter figure was, of course, an error. The correct reading should be "25 or 4 watts." The other error occurs in the note entitled "A Pleasing Shop-Lighting Installation," on page 44. We understand that in this case 100-watt lamps were used on the ground floor, but 500-watt units were installed above the well-glass roof, seen in the background.

HOME BRANCHES:

BRIGHTON: 35, Duke St. ('Phone: Brighton 5512).

BIRMINGHAM: 21/22, Newspaper Hse., 164, Corporation St. ('Phone: Central 3741).

BRISTOL: All Saints' Chambers, 41, High St. ('Phone: Bristol 8069).

GLASGOW: 23, Douglas St. (Telegrams: "Starter, Glasgow." 'Phone: Central 1253).

LONDON: Thanet Hse, 231/2, Strand, W.C.2 (Telegrams: "Cryselco, Estrand London," 'Phones: Central 3016-7-8).

Gems in the Crown of Light

HOME BRANCHES:

NEWCASTLE-ON-TYNE: 27, Grey St. (Telegrams: "Cryselco, Newcastle-on-Tyne." 'Phone: Central 3295).

LEEDS: 11, New Station St. (Telegrams: "Cryselco, Leeds." 'Phone: Leeds 27866).

MANCHESTER: Douglas Chambers, 63, Corporation St. (Telegrams: "Cryselco, Manchester." 'Phone: City 9120).

CARDIFF: 30, Charles Street. ('Phone: Cardiff 7466).

CRYSELCO

OPAL LAMPS

The Cryselco Opal is "the lamp with two skins." *It gives light without shadow or glare*

CRYSELCO LTD., KEMPSTON WORKS, BEDFORD

Telegrams: "CRYSELCO, KEMPSTON" *Telephone: BEDFORD 3277/8*

Col. Chris Elco of the Cryselco Brigade

OF COURSE SHE IS PLEASED!

She has seen the Trade Mark and knows it is "Hailglass" and that the price is reasonable, and that no other glass equals it for beauty, charm, delicacy and utility. Again! All patriotic ladies now are determined to live under the rays of BRITISH GLASS only and to boycott the foreign glass (often made by hands covered by the blood of the Britons they slaughtered in the Great War). "HAILGLASS" is made only at Morley, nr. Leeds.

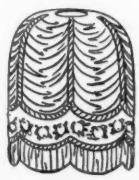
Sole Makers:

HAILWOOD & ACKROYD Ltd.

MORLEY, nr. LEEDS.

Branches and Showrooms:

98, Mansell Street, LONDON, E.1
32, Shaftesbury Avenue, LONDON, W.1
21, Waterloo Street, GLASGOW

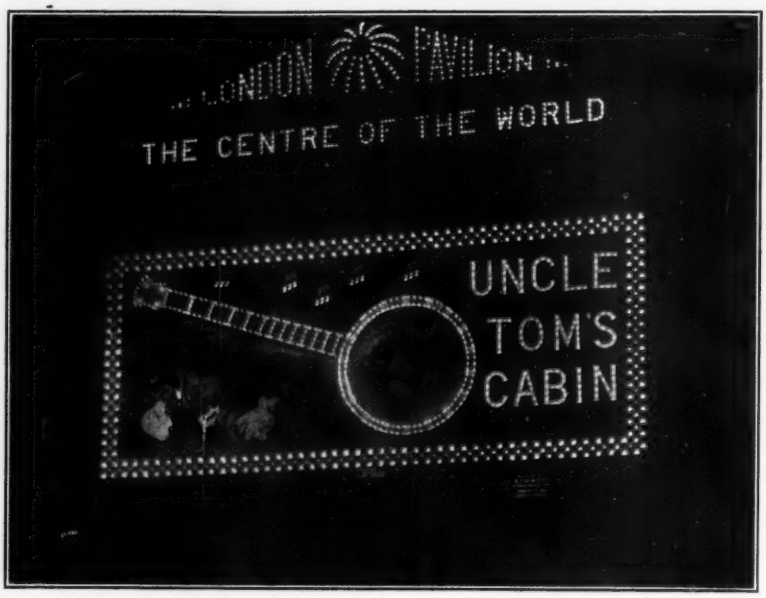


A STRIKING ELECTRIC SIGN.

The ingenious sign here illustrated is the result of co-operation between Mr. John de Frene, the well-known publicist, and Mr. J. M. Woolnough, of the Strand and Interchangeable Signs Ltd. The sign, as a whole, is approximately 44 feet by 18 feet, and includes a banjo device, which is itself 32 feet high and 12 feet long, outlined in electric lamps. Below this is a picture of a negro dance, and the title of the film is outlined in electric lamps at the side.

The most ingenious feature of the sign, which is installed in connection with the film production "Uncle Tom's Cabin," at the London Pavilion, is the device by means of which the lights of the banjo are operated by an electric flasher, so as to give the effect of being operated by unseen fingers. At the same time various notes of music are displayed by means of box signs above the device.

Simultaneously with the operation of the sign the musical banjo accompaniment is supplied by the "Panotrope" amplified gramophone apparatus. The music is sufficiently loud to overcome the roar of the traffic, and the combined effect of the sign and the musical accompaniment is very striking.



A Night View of the "Uncle Tom's Cabin" Sign recently installed by Strand Interchangeable Signs Ltd. at the London Pavilion.

One other point of interest in connection with this sign may be noted—the remarkably expeditious manner in which it was installed. We are informed that the sign was designed and prepared within 10 days, and that the removal of the old sign and erection of the new one was carried out within 20 hours—truly a quick performance!

HIGH CANDLE-POWER FLAME ARC LAMPS FOR PUBLIC LIGHTING.

The use of flame arc lamps of relatively high candle-power for streets, squares and open spaces is familiar. It has always been recognized that the flame arc has exceptional opportunities for this form of outdoor lighting. Lamps consuming up to 10–15 amps. have frequently been adopted in the past.

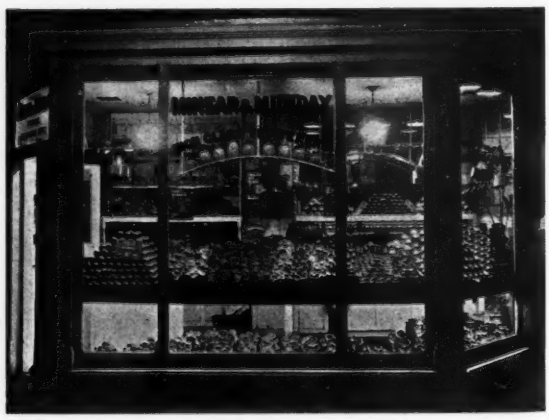
Showing Group of four 30-amp. Dia-Carbone Lamps, as recently installed in the Königsplatz, Leipzig.

A striking new development, however, has been the introduction in Germany of a form of "Dia-Carbone" enclosed-flame arc lamp consuming 30 amperes and yielding approximately 8,000 candle-power (mean hemispherical). From information supplied to us by Messrs. Korting & Mathiesen Electrical Ltd. we understand that these lamps, like those of smaller consumption, operate (with a single pair of carbons) for about 120 hours without requiring recarboning, and at a specific consumption of 0.21 watt per candle (mean hemispherical). Such lamps are commonly operated two in series on 110 volts, or four in series on 220 volts. In the latter case a special substitution resistance is provided, and this automatically replaces a lamp in the case of a defect arising so that the operation of the others in series is unaffected.

The illustration shows a group of four such lamps mounted on a high standard, in the same manner as had been recently adopted for the lighting of the Königsplatz in Leipzig. It is recommended that owing to the high candle-power of these lamps the mounting height should not be less than 20 metres (approximately 60 feet), which, of course, is very much more than is usual for street lighting, and places the sources well above the normal range of vision. As a group of four such lamps would furnish over 30,000 candle-power, the brilliant effect of this method of lighting may be imagined.

A BRILLIANT SHOW WINDOW.

The view below shows the brilliantly lighted show window of Messrs. Minear & Munday, fruiterers, in Victoria Station. The conditions are somewhat exceptional. The available daylight illumination is hardly sufficient to show off the window properly, so that artificial light has to be used to a great extent during daylight hours. At the same time, in view of the



presence of daylight, a high illumination is necessary. With the Holophane units fully utilized the illumination in the window approaches 100 foot-candles, and it forms a familiar and striking object. We understand that the good illumination has had a favourable effect on sales. During the busy hours there is a continuous crowd outside the window. The glass is kept scrupulously clean, and this, together with the high illumination, has had the amusing result that people sometimes fail to see the glass entirely: it is a common experience for them to bring their face or hat in contact with the window! The late Mr. L. Gaster was responsible for this installation, which is an excellent example of modern show-window lighting.

THE INTERNATIONAL COMMISSION ON ILLUMINATION.

DEAR SIR,—

Mr. Good's reply to my letter in your issue of November showed me that, through an error, the cause of which it is impossible for me to trace, a phrase was included in my letter which should not have been there. I must apologize to Mr. Good, as well as to your readers, for this error. When speaking about the work which will be dealt with by the various national committees I said : " This might appear a step in the right direction, but the plan is not likely to answer well." The second part of this phrase expressing an opinion contrary to that which is stated in the first part, I should like to repeat that this transfer of work to the national committees is an *excellent* scheme, from which very good results can be expected.

I am quite well aware that the Bellagio meeting was only an extended meeting of the Executive Committee, and not a regular plenary I.C.I. meeting. My objections, however, apply to both, and, as a matter of fact, they also applied to the Geneva meeting of 1924. For it is the present form of the organization of the I.C.I. meetings which makes it impossible to deal with points of general interest in the same way as an international congress of illuminating engineers could do.

The I.C.I., as it is, is certainly well suited for the " official " work related to units, standardization, nomenclature, specifications, codes.

But all other work, e.g., papers on subjects which are of technical interest, but likely to lead to important discussions, should be dealt with in some plenary sessions, which are open *not only to the delegates but to anybody* who is interested in illuminating engineering and who *cares to come* to the place of the meeting. There seems to be no objection to charging some fee from those persons for attending what might be called the " congress " part of the I.C.I. meeting.

As to the way in which it should be ascertained whether the papers presented are of good quality, I quite agree with Mr. Good that this responsibility can be taken by the National Committees. I am not in the counsels of the British National Illumination Committee, but even if I were I could hardly state what papers should not have been presented at Bellagio—simply because these were *not* amongst the well-prepared contributions by members of the *British* Committee.

There was at least one paper read which, in the opinion of many delegates, merely caused a *loss of time;* and there was another paper which was *withdrawn* in time, and which only, therefore, did not share the fate of the other paper. Such things should not occur again.

I am afraid, however, that the National Committee, of which the authors of these two papers were members, would never have rejected the papers, even if they had been submitted to them beforehand.—Yours very sincerely,

OBSERVER.

PERSONAL.

Mr. E. H. W. Cooke, who occupies the position of Comptroller in the Metropolitan-Vickers Electrical Co. Ltd., has recently been appointed Chairman of the Board of Directors of Metro-Vick Supplies Ltd., Cosmos Lamp Works Ltd., and Harcourts Ltd., the Company's Birmingham factory, where high-class electric light fittings, electric fires, and other electric domestic helps are manufactured.

The Cosmos Lamp Works are mainly concerned with the production of the Company's lamps and well-known wireless valves, other electric domestic appliances such as cookers and fans being manufactured at Trafford Park.

INDEX (February, 1928).